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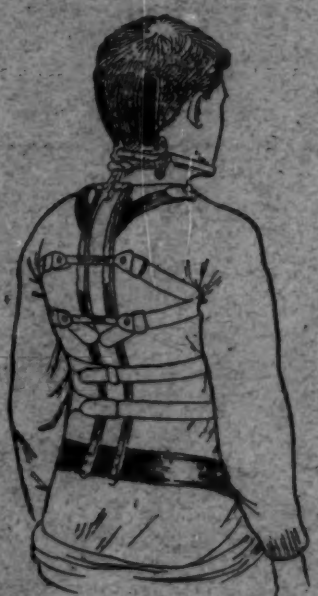

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THE ANATOMY OF SNAPPING HIP

F. WOOD JONES, LONDON.

For the privilege of examining the living anatomy of two cases of so-called "snapping hip" I am indebted to the kindness of Mr. W. H. Trethowan of the Special Military Surgical Hospital, Shepherd's Bush. The particulars of the two cases are as follows:

CASE I. Bombardier, A. H., aged 26; lost grip of horse when riding in July, 1916, and when dismounted had real difficulty in walking.

CASE II. Corporal, A. E. F., aged 20; slipped in April, 1916, and has walked with a limp ever since.

X-rays and examination under anaesthesia revealed nothing. The snap was produced in both cases by the man standing and rotating his affected (right) leg while it was supporting weight. In both cases the snap could be produced by movement from extreme internal rotation to extreme external rotation and vice versa.

Both cases were treated by manipulation, contrast baths and gymnasium without improvement. On the operating table it was impossible by manipulation of the leg to reproduce the snap made during life, nor was any structure capable of causing the condition obvious from examination. The gluteus maximus was, therefore, electrically stimulated and while it was in a state of active contraction the leg was again manipulated. The snap was now elicited every time the great trochanter was rotated backwards or forwards between the gluteus maximus. Upon dividing the fascial insertion of the muscle and reflecting it towards the middle line it was at once apparent that the structure which infringed on the trochanter and caused the snap was the tendon developed on the deep surface of the muscle. This tendon constitutes the insertion of the gluteus maximus to the gluteal ridge of the femur and it

was apparent that in these two cases the tendon was in an abnormal state of development. (See Fig. 1.)

From examination of the cadaver, since seeing these cases on the operating table, I have come to realize that this tendon is an extremely valuable structure. The gluteus maximus may have but

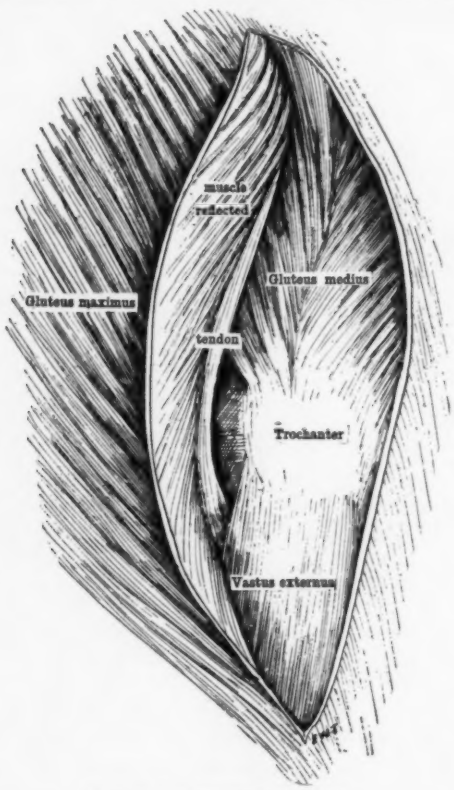

FIG. 1.—"Snapping Hip"

a small insertion to the femur effected by short musculo-tendinous fibres (See Fig. 2); or it may have an extremely well developed sickle-shaped tendon springing from its deep surface and passing a very considerable distance down the shaft of the femur. In these cases of snapping hip this large sickle tendon was of unusual development.

There are several points of interest in this condition. In the first place, with the relaxation of the muscles present during the operation the real cause of the condition cannot be detected, and

the surgeon is likely to blame some unrelaxed ligamentous structure. Then from a phylogenetic point of view this tendon of the gluteus maximus is of interest since this large insertion of muscle to the femur is a distinctive primitive feature, and one which is waning in man with the increasing importance of the fascial insertion. That in these two cases the tendon was the offending

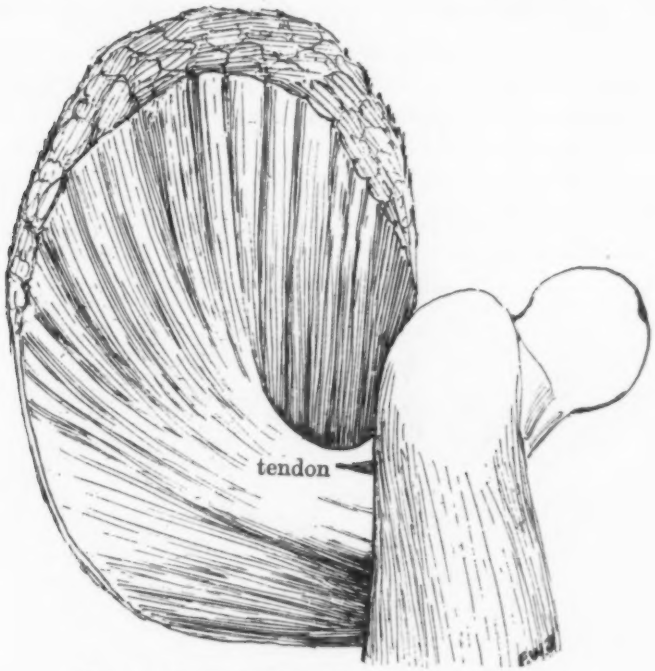

FIG. 2.—Deep Surface of the Gluteus Maximus.

structure was confirmed by the fact that stitching it down to the whole length of the great trochanter put a stop to the production of the snap. From an examination of a series of tendons in the disecting room it appeared probable that many persons would have some power to produce a snap as the trochanter passed backwards and forwards under the tendon.

I find by examining students that this is actually the case, and I suspect that in the two cases operated on the history is not reliable and that an individual peculiarity had been exploited for military purposes.

DEMONSTRATION OF RADIOGRAMS OF A CASE OF TUBERCULOSIS OF ONE HIP ASSOCIATED WITH CONGENITAL DISLOCATION OF THE OTHER HIP.

BY A. ROCYN JONES, LONDON.

British Orthopaedic Association

My excuse for bringing this case to the notice of the Association is its extreme rarity and the problem involved in treating, at one and the same time, Tuberculosis of one hip and Congenital Dislocation of the other.

W. B., aged 3½ years, was admitted to the Royal National Orthopaedic Hospital on May 17th, 1916, with a history of limping on the right side ever since he began to walk. A congenital dislocation of the right hip was diagnosed, and later reduced by mani-

1. W. B. Aged 3½ years. A radiogram showing Congenital Dislocation of the Right Hip.

pulation, although the rudimentary lower and posterior acetabular rim made it difficult to be certain when the head was actually in the cup. Both limbs were encased in Plaster of Paris, the right being hyperextended and abducted 110°. In the next plaster a few months later the right hip alone was encased. The boy was ex-

amined from time to time and appeared to be doing well, but on January 11th, 1917, he was brought to the Out-Patient Department with a large fluctuating swelling on the front and inner side of the upper third of the left thigh; this being first noticed by the mother ten days previously. The boy was quite comfortable and movement at the left hip joint was free and painless. A radiogram showed necrosis of the ilium and upper part of the acetabulum. Next day eight ounces of typical tuberculous pus were evacuated through a cannula.

In order to treat the two conditions and counteract the left femoral head from upward wandering, the plaster was discarded and the boy put upon a modified double Thomas' splint with a bar along each side of the left limb and a joint, controlled by a key,

5.—W. B. The present condition of the left hip; much new bone formation with firm ankylosis.

opposite the right hip. By this means the right thigh could be abducted at any desired angle, and at the same time the left limb was continuously extended and slightly abducted.

A few weeks later a sinus appeared in the left groin but the splint allowed the daily dressing to be easily carried out, without disturbing the position of the limb. After some months the sinus closed up but in February, 1918, an abscess developed again in the groin and was evacuated. Later a sinus reformed but healed again in August, 1918, and has remained healed. The disappearance of the pus and the closing of the sinus coincided with the formation of bony ankylosis at the hip joint as revealed in the radiogram.

6.—W. B. The present condition of the right hip; the head in good position; the roof of the acetabulum although somewhat sloping shows good cupping.

Pari passu with the treatment of the tubercular joint the abduction of the right thigh has been gradually diminished so that by now the right half of the instrument is discarded and the boy allowed to exercise his right limb. But owing to the abscess and recurring sinuses of the left hip it has been thought well to continue immobilization of this limb until the completion of a year from the complete healing of the sinus. At the end of that time, i. e. a few months hence, the boy will be allowed to get about gradually. At present the boy's physical condition is better than at any time and he is putting on weight. The left hip is firmly ankylosed with the limb in good alignment, the reduced dislocation on the right side remains thoroughly stable under all movements of the thigh. but a little external rotation of the limb remains.

STRIPPING OF THE OS CALCIS.*

ARTHUR STEINDLER, M. D., F. A. C. S., IOWA CITY, IOWA.

In 1917 the writer described an operative procedure for the relief of certain cases of cavus deformity of the foot. The operation consists mainly in the subperiosteal stripping of the muscular attachments to the anterior surface of the os calcis.

Anatomical studies show that conditions are favorable for such procedure, in as much as the muscular attachments of the small muscles of the foot are concentrated about the inner and outer tuberosity of the os calcis, from which they rise in three compartments occupied by the abductor of the 5th toe, the common short flexor of the toes and the abductor of the big toe. This compartmental arrangement of these structures, their relation to the plantar fascia above, to the deep ligamentus structures below the muscles, especially the division in three compartments by perpendicular extension of the fascia to each side of the short flexors of the toes and the relation of their septa to vessels and nerves is of considerable interest as it opens a number of operative possibilities for the foot, other than the one described. Dr. H. J. Prentiss, Professor of Anatomy at the State University of Iowa, has made a thorough and most interesting study of this subject.

It appears that the vessels and nerves entering the foot below the inner malleolus are carried in closed proxmity to these septa, entering at a point in front and median to the inner tuberosity of the os calcis. There is, however, sufficient space between the vessels and the internal tuberosity to make the insertion of the periosteotome at the latter point, a safe procedure.

The operation does not intend to do more than to free a muscle bound claw foot or hollow foot from the strain of contracted musculature of the sole of the foot. Any deformity arising from abnormalities of the skeleton must be taken care of by additional bone operation.

The technic used may be shortly described as follows:

A curved incision is made horizontally from the posterior aspect of the heel in front to the inner side of the foot, reaching to a point 1½ inches in front of the tubercle of the os calcis. The upper surface of the plantar fasciae is then dissected from cover-

*Surgery, Gynecology & Obstetrics, May, 1917.

ing fat layer of the foot and made free thru the entire width of the fascia to the lateral side of the foot. The fascia is then incised across at its insertion to the lower surface of the os calcis. A sharp periosteal elevator is then inserted and a subperiosteal stripping of all structures attached to the lower surface of the os calcis is carried out. Fig. 1 and 2.

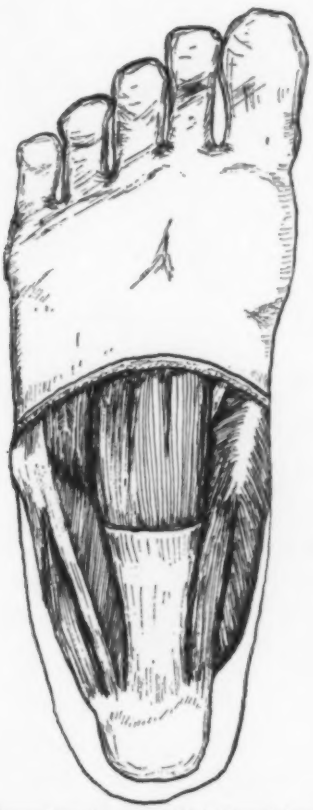

Fig. 1 - Superficial Layer of Foot Musculature. Abductors of 1st and 5th Toes and Common Short Flexor Arising from Tuberosities of Os Calcis.

It is necessary to extend the stripping over the under side of the os calcis to its junction with the cuboid in order to detach the ligamentum plantare longum, which is often contracted and the cause of the cavus deformity, at the outside of the foot. By keeping close to the inner tuberosity of the os calcis one is at safe distance from the plantar vessels and nerves. After the stripping

process has been carried out the wound is closed by subcutaneous suture, and the skin is sutured with cat-gut.

In some cases this operation had to be accompanied by osteotomy of the tarsus in order to overcome the cavus deformity of the skeleton.

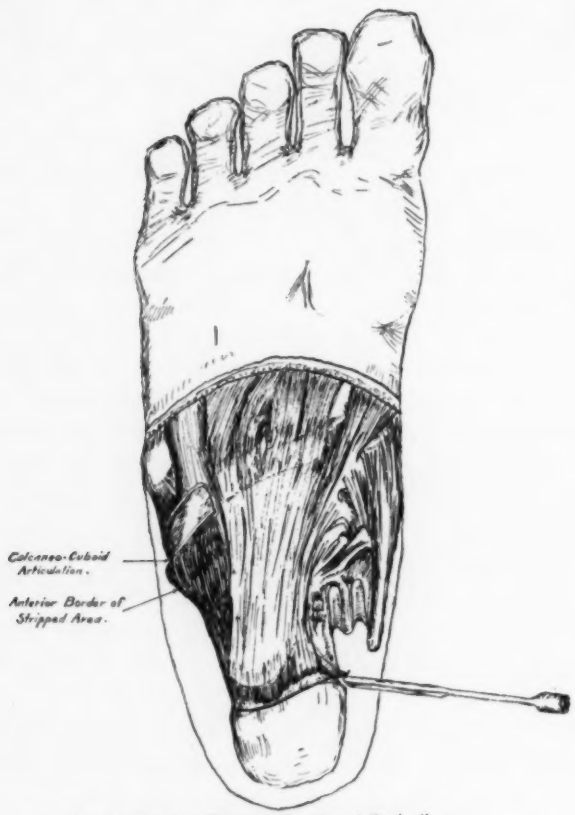

Fig. 2 - Incision Through Fascia and Periosteum. Insertion of Chisel at Inner Tuberosity.

In a series of other cases dropping of the first metatarsal and retraction of the big toe was overcome by Sherman's procedure, that is, by severing the extensor of the big toe beyond the metacarpal phalangeal joint and fastening the tendon to a point proximal to the head of the first metatarsal.

Since 1916 over fifty cases have been operated on with this method, comprising more than sixty deformed feet.

Infantile Paralysis: 36 cases:
- Equino cavus 18 cases
- Equino varus 4 cases
- Simple varus 6 cases
- Simple cavus 8 cases

Spastic Paralysis: 5 cases:
- Spastic varus 3 cases
- Spastic cavus 2 cases

Traumatic Paralysis: 4 cases:
- Equino cavus 1 case
- Simple cavus 3 cases

Congenital Claw Foot, Non Deforming Club Foot: 4 cases

Congenital Club Foot: 2 cases

Attention is called to two cases of Infantile Paralysis with isolated paralysis of the tibialis anticus. I believe that isolated paralysis of the tibialis anticus is very prone to cause cavus deformity because this muscle essentially extends the arch of the foot and the abscence of its action, therefore, predisposes to cavus deformity.

The cases operated vary in age from 5 to 20 years, and in duration from 6 months to 18 years.

OPERATIVE PROCEDURE APPLIED.

Stripping of the os calcis alone in 12 cases.

Stripping of the os calcis in combination with osteotomy in 6 cases.

Stripping or the os calcis and correction to overcome deformity, carried out in 9 cases.

Stripping of the os calcis associated with tendon transplantation or tenoplasty in 24 cases.

It should be mentioned that simultaneous tenoplasty of the Tendo-Achilles should be avoided because of the great mechanical advantage of tension of the intact Tendo-Achilles in correcting the cavus deformity.

In the analysis of final results a number of cases are omitted who have either not reported at all after operation, or have not done so for a sufficient length of time.

Cases operated for 6 mo. to 1 year:		Results:
Number of cases: 12	Good.	Walking in shoe, 9 cases. Wearing braces, 3 cases.
Cases operated on 1 year or more:		Results:
Number of cases: 19	Good.	Walking in shoes, 14 cases. Walking in braces, 5 cases.

The longest time of observation is 2 years 6 months.

I believe the operation can be recommended in cases of cavus deformity with contracture of the soft parts of the sole of the foot; also in cases of cavus deformity with skeletal changes as adjunct to osteotomy or manual correction; lastly in a number of cases of paralytic or congenital club foot or equino varus deformity as an adjunct to manual correction.

THE TREATMENT OF FRACTURES OF THE FEMUR FROM AN ORTHOPAEDIC POINT OF VIEW.

CAPT. J. P. JONES, CAMDEN, ALABAMA.

GUNSHOT INJURIES OF THE FEMUR.

Gun-shot wound injuries of the femur constitute one of the greatest tragedies of the war, not only because of the fatality with which they are attended, but also on account of the deformity and shortening so often present.

In January, 1918, Sir Robert Jones stated that the "question of fractures of the femur is essentially one of preventive surgery." Orthopaedic centers in England are constantly dealing with deformities following this injury. Many of the cases come in with 4 to 5 inches of shortening, and every variety of malposition. He also stated in January, 1918, that the mortality was far too high and that every effort should be made to standardize the treatment of fractures of the femur on the most efficient plan. "The remedy consists of leaving these fractures in the hands of specially trained men, who should be retained for this work only."

Just prior to this address Special Femur Hospitals had been formed in France and in England. The bombing of April and May forced all femur hospitals to evacuate wounded to England, where the work was carried on.

Two fundamental principles must always be followed in the treatment of Fractured Femurs:

1. Efficient fixation of the fracture with correct alignment as possible.

2. Early and frequent movement of neighboring joints.

Death when it occurs early is often due to shock, the result of direct injury. The shock is always increased by the movement of the tissues and exposure. Fixation therefore should not be delayed a moment. For the purpose of "rapid, simple and efficient" fixation there is no splint like the Thomas. The splint can be applied over the trousers, and extensions made from the boot or looped bandage around the ankle with the boot on. If a compound fracture the operation should be done in the splint; practically all of our operations were done in the splint. This

has the advantage in early cases of not disturbing the position of the fragments.

The justification of the Special Femur Hospital lies in the terrible mortality and crippling during the first two years of the war. Result so disastrous that surgeons at one time advocated amputation in all fractured femurs in France. Col. Grey, R. A. M. C., has stated that the percentage of death in fractured femur cases that reached the C. C. S.'s in 1914-15 was 80 per cent. Death rate in C. C. S. was 50 per cent. In 1918 it was around 15 per cent. The Thomas splint was first used by the English in large quantities in April, 1917, at the battle of Arras.

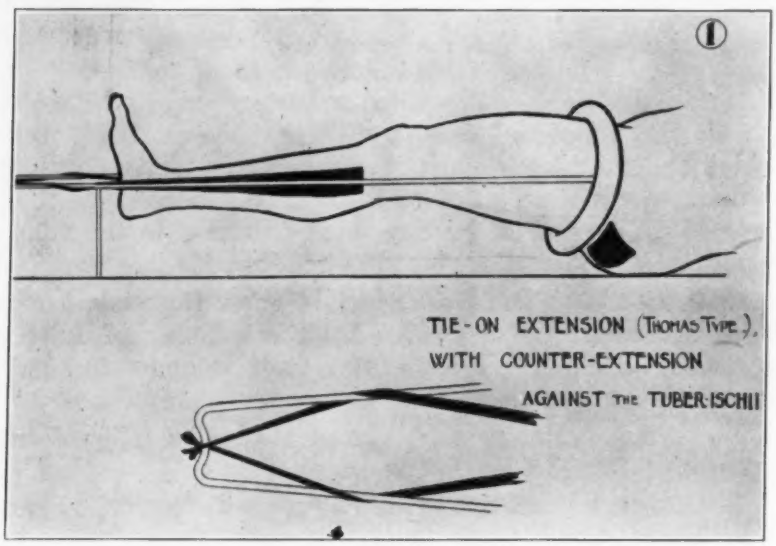

FIG. 1

The immediate result was a reduction of the mortality in the C. C. S. to 15.6 per cent. It is also interesting to note that the same time special operating teams were rushed to any point of the line where a push was on; coincident with this came the practice of *thorough excision of dead and damaged tissue* with a resultant drop in the mortality from gas gangrene and sepsis. The net result of the specialization was good; the death rate in base hospitals fell to about 3 per cent. Secondary hemorrhage was practically abolished.

TREATMENT OF FRACTURES OF THE FEMUR.

The treatment of femurs has received so much attention lately that a large number of splints have been evolved. The majority are too complicated or too expensive for ordinary use. The splints most universally used are Thomas and Hodgen's or modifications of the same.

Extension and immobilization of the fracture are fixed principles that no one disputes. But there is considerable difference of opinion as to how extension is to be made and maintained and how much immobilization includes. All methods of extension come under two heads; the so-called fixed extension and the extension by weights. The Thomas splint is used in France and in England in large numbers, but in variety of ways, many of which are not actually on the Thomas principle—which is of course

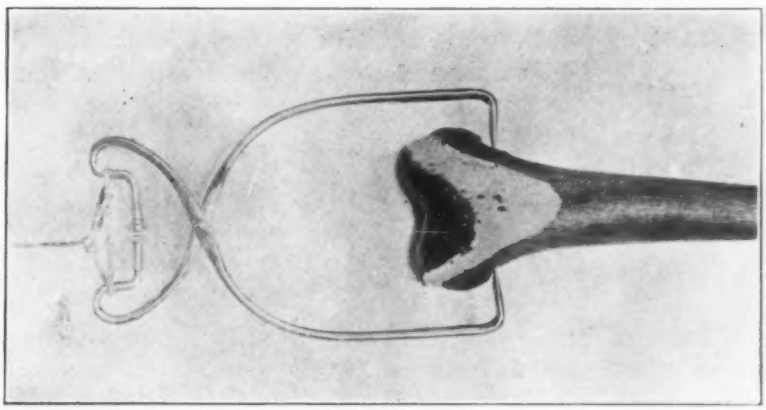

FIG. 2

that the ring is pressed against the Ischial tuberosity, and the leg tied to the other end of the splint as forcibly as possible (Fig. 1), this being true fixed extension. Another way to use the Thomas splint is to suspend the limb in it, using the splint merely as a cradle, and making the extension from an independent post by weights and pulley, or tying the limb to the post and elevating the foot of the bed. The objection to this method is the use of the entire limb for extension purposes, and the consequent immobilization of the knee.

A frequent sequel to the prolonged immobilization of a limb for the treatment of a fracture, is rigidity of joints and muscles. This disability sometimes comes to be permanent, and in most cases necessitates weeks of treatment after union to produce a movable joint. The avoidance of this complication is therefore desirable. The absolute fixation of the whole limb therefore cannot be the right principle. This brings up the question of how much immobilization includes. The older text books lay down the rule, "that when possible the joints above and below the fracture should be immobilized." This practice in the treatment of femurs is still being adhered to, and has the disadvantage that convalescence is prolonged by the time necessary to restore mobility to the knee joint. Obviously the ideal is fixation of the injured part with sufficient freedom of movement of the uninjured parts to maintain their functional activity. The Thomas splint, per se, is excellent for immediate application in First Aid, or for limited periods, but if used over any length of time, produces rigidity and wasting, deplorable because it can be avoided. The principle of fixation of injured tissues with mobility of the normal is not of course original, but its practical application so far as I am aware is not general.

Essentially there are two methods of extension; one is taken from the skin surface by some adhesive applied to the skin; in the other a direct hold is obtained on the bone by some instrument, E. G. Calipers, a pin through the head of the Tibia, or screws into the Tibia.

There can be no question that the direct pull on the bone is the more efficient, and comparing the number of cases of skin infection and sloughing following the use of strapping and glue, with the number of cases of sepsis following the use of calipers and screws, I prefer the instrumental extension. The patients who have had both tell you the same.

One of the most recent instruments is that devised by Major Besley, U. S. A. M. C., and called by him "Ice Tong Calipers." (Fig. 2.) For the simplicity of application and small amount of injury to the bone it seems superior to other instruments, while giving absolute control over the fracture. We have used this instrument with modifications by Major M. Pearson, R. A. M. C., for some time. He has used it for over a year.

Put very briefly, our method consisted in weight and pulley extension applied through the "Ice Tong" calipers to the lower end of the femur, "which they grip but do not penetrate." The lower part of the limb is free, flexed and supported on a knee flexion splint grafted on the Thomas at the level of the knee. The third thing that we insisted on was the suspension of the ring, so that it rested at all times against the Ischial tuberosity. This was done by counter-weights and pulleys or by a string from an

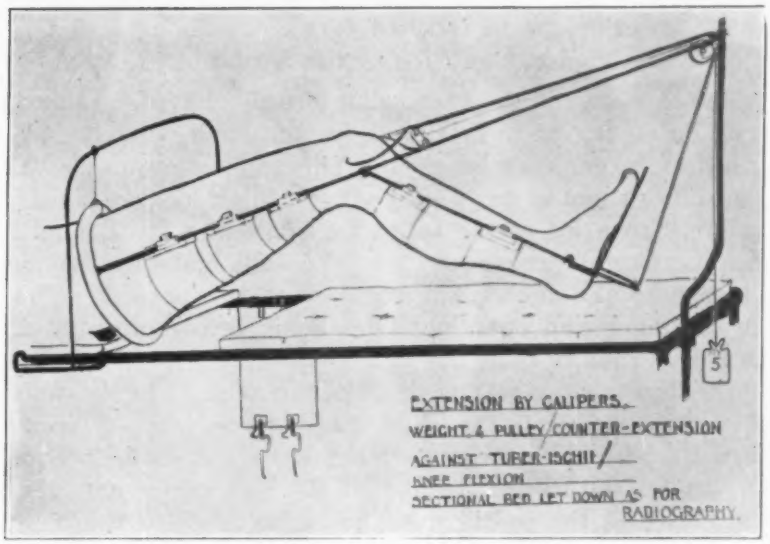

FIG. 3

overhead bar. The pull from the calipers is taken by a cord to a metal ring shaped to resemble a hexagon. The weights are attached by a cord to the other end of the metal ring. The hexagon allows full extension of the leg. (Figs. 4 and 5.)

By using counter weights to suspend the ring one can treat a fracture on fracture boards. We used a special fracture bed, in which a section dropped out and the bed pan was inserted from below. This method obviates moving the patient, thereby increasing his comfort. This arrangement is comfortable for the patient and permits him a reasonable amount of movement without disturbance of the fracture; gives ready access to the wounds, and can be placed in any degree of abduction desired.

I know of calipers remaining in twelve to fifteen weeks without giving trouble, but in my opinion five to seven weeks is long enough with the average case. After that time when some active movement is permissible and desirable a simple weight of five pounds and a glue or strapping extension to the leg or thigh is sufficient to hold him in the splint and prevent shortening.

There is one other point of interest in the use of the caliper —that is the treatment of lower third fractures. With the knee slightly flexed the calipers pull over a fulcrum with the result that the lower fragment is tilted forward, over extension is prevented by the Vastus, tightened by the flexion of the knee.

The skin around the knee being already shaved, swabbed with a solution of flavine in spirit, (1 in 500) and surrounded with sterile towels, gas may be given. The application of the calipers is not difficult and is made easier if the thigh has previously been lifted well forward in the splint by tightening the flannel bands under it. Certain apparently trivial details make a great deal of difference to the subsequent comfort of the patient. The skin over the inner and outer condyles being drawn up and slightly forward so that it shall not be tight over the patella. A cut is made with a narrow scalpel through the skin, B1PP is rubbed in, and without relaxing the skin the sterilized caliper points are inserted. The skin puncture must be large enough—about an inch—to let the caliper points go through easily and not be a tight fit. And the points must go right down to the bone, any intervening piece of fascic will lessen their grip. But they should not enter the bone, still less is there any need to drill the bone. The exact site of insertion is important. With the most ordinary care as to landmarks there is no fear of puncturing the knee joint. The available area of safety is a good deal more than the width of the thumb; (See Figures 9 and 10), at the inner side of the landmarks are easily found; the cut should be made a finger's breadth on the proxinal side of the adductor tubercle, not on its tip. At the outer side the guide is less definite but the site for puncture is proximal to the most prominent point of the outer condyle and in front of the ilic-tibial band. The latter or rather its junction with the intermuscular septum is easily felt in oneself if one stands with a leg extended straight out in front unsupported. It is not so easily felt in an unconscious patient with lax muscles and a slightly flexed knee, but it can

be felt and it is a matter of some little importance because that band moves backwards and forwards in subsequent movements of the knee and if penetrated may drag on the caliper and cause pain.

Roughly speaking the outer point of insertion is about 1½ inches from the outer border of the patella above its middle. The only common mistake in putting on these calipers is to put them too far forward, in front of the broadest diameter of the bone, they then grip a sloping surface and tend to gradually slide further forward and drag the skin, this especially on the inner side, which is the more sloping.

The blades being inserted the surgeon holds them firmly while the orderly ties up the handle ends to the hexagon as shown in Figure 6 and carries on another cord from the hexagon over the pulley to a brass spring hook into which the sand bags are hung. For any recent case, say under a week old, one ten-pound weight is ample. For older cases if there is shortening of two or three Cms. up to fifteen pounds may be required at first, reducing as the limb lengthens.

The weight now being on, the surgeon can relax his hold of the calipers which will continue to hold securely as long as the pull on them is maintained. Nurses must be instructed that on no account must the weight be removed or lifted for that would immediately loosen the hold of the calipers and possibly dislodge them.

While the patient is still under gas the old gauze and glue extension or any other form of extension below the knee is removed and the knee flection piece slightly lowered. Provided the orderly has everything well prepared beforehand, it is quite easy to do it all under gas in a very few seconds but anyone who has not done it before might be wise to use ether. The only dressing used is a narrow strip of flavined gauze at each point of insertion.

As to the mechanics of the caliper, the principle is exactly that of the ice tongs, the stronger the pull, the firmer the grip. Alos the inward grip of the points is greatest when the cord joining the handle ends is straightest and it should be made so. In the simple ice tong pattern of caliper as originally used the points were inserted, not merely down to but right into the bone.

There was a continuing tendency for the points to be driven into the bone, deeper and deeper, opening up cancellous tissues, causing persistent sinuses, and in one or two cases it has happened that the knee joint has been infected. This cannot happen with the form of caliper, a modification of Besley's which we are now using with an adjustable screw-bar between the handle ends.

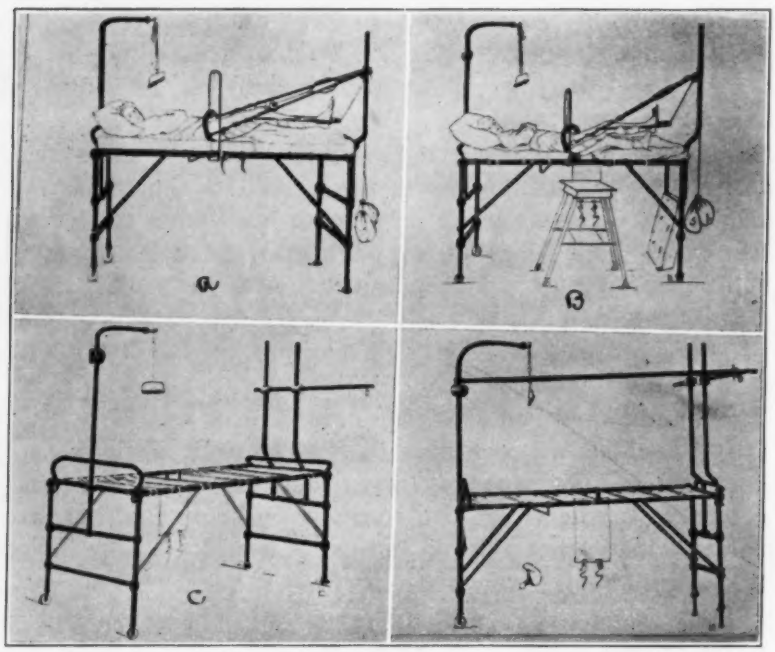

FIG. 4

When the calipers are on and have got their grip firmly on the surface of the bone this screw is adjusted so that daylight is just visible between its ends. In most cases this separation lasts many weeks showing that penetration is very slow to occur, if at all, and the check bar prevents it from ever becoming more than of the slightest.

The efficiency of this method of extension depends upon the counter extension of the tuber ischii pressing against the ring of the Thomas; that alone prevents the weight from gradually pulling the patient down the bed. The relative position of the tuberosity and the ring must therefore be frequently scrutinized by

the surgeon; as long as the ring is suspended there should be no trouble. There is no need to tilt the bed. One must remember that the end of the Thomas is fixed to a wooden upright.

Owing to the very high mechanical efficiency of a weight pulling directly on the bone instead of sliding through layers of skin and muscle, a 15-pound weight is ample in most cases and this is not enough to cause painful pressure of the tuberosity against the ring. In the rare cases where pressure there is painful, slight tilting of the foot of the bed will make the patient slide away from it, ease the pressure on the tuberosity and the counter extension in that case becomes the patient's own body weight; practically his splint then acts as a "Hodgen" instead of a "Thomas."

When there is a wound in the region of the buttock a half-ring Thomas or "Hodgen," with the bed tilted at the foot, gives efficient extensions and makes dressings easy.

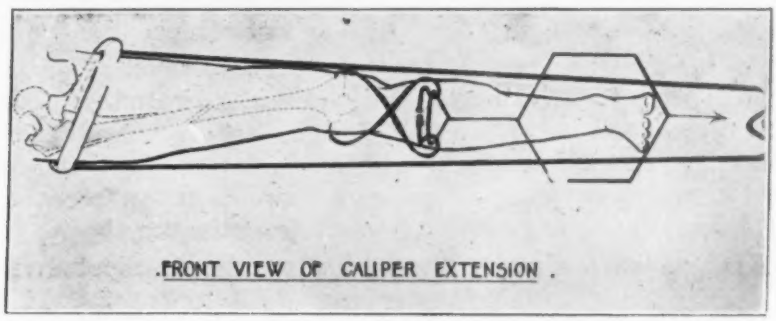

FIG. 5

If the fracture is in the upper fourth, the proximal fragment requires a position of abduction, flexion and slight external rotation to get the correct alignment, the leg and lower fragment must be moved into the same position. Instead of one extension post at the foot of the bed, two are put in, and a third bar clamped horizontally across the other two at any desired height and projecting as far beyond the side of the bed as necessary, affords means of fixing the lower end of the Thomas with any degree of abduction and flexion desired, and yet leaves easy access to all parts of the patient. The position of the bone should be checked by radiography for it is very easy to over-abduct. **(Fig. 4c.)**

In spite of precedent the practice of abducting and fixing both legs is unnecessary and I think surgically unsound. It is based on a false analogy with abductions of the tubercular hip. In the cases we are dealing with the alteration of position takes place at the fracture, not in the hip joint, and abducting the leg below the fracture is simply restoring its natural line and putting it into the position of greatest ease. The patient has no inducement to "dodge" it by tilting the pelvis and as a matter of fact he does not do so. This is obvious to the naked eye on examining cases, but in addition we have accurately measured the true angle of abduction of the injured leg, there is no difficulty whatever in getting and maintaining 25 or 30° of true abduction, the sound leg being left free.

This is a really important point. Not only is it a great comfort to the patient to have his good leg free while he is in bed, but it aids nursing, and when the time comes for him to get up and about he has the great advantage of starting with one good leg, instead of both being more or less atrophied and stiff.

The method here described is our routine method for all fractures, simple or compound and the patient remains in this "first position" for several weeks until in fact there are definite signs of union and normal temperature. Movements of the leg, at first only through a few degrees, afterwards more freely, are carried out daily *by the surgeon himself* from the very beginning.

When union has begun the second position is adopted; the only change being that the lower end of the splint instead of being closely tied to the extension post is now swung from above by a cord, weight and pulley, the pulley being fixed to the top of a spare derrick or other overhead suspension at the foot of the bed. This allows the patient greater freedom of movement. At this stage the weight extension in the line of the thigh is necessarily done away with and its place taken by elastic or spring extension inserted between the hexagon and the end of the splint. A very handy and efficient form of a spring extension is a small spring balance; a glance at the indicator shows at once whether it is doing its duty and what its pull is. Its efficiency depends entirely upon the counter pressure of the tuber ischii on the ring and this must be maintained.

The later stages will not be detailed here. The patient becomes more convalescent and his femur less and less dependent upon extension apparatus. His knee and ankle are kept mobile throughout and long before the thigh is able to bear the patient or indeed any weight on it, he is able to get up and walk about on the Thomas. "Walking Caliper Splint," with the special light boot supplied.

The advantages of calipers as a means of extension are so manifest, their mechanical efficiency and directness, the freedom of all the leg and joints below the fracture, the fact that they can be applied irrespective of the position or size of wounds of the thigh (very satisfactorily even through an open wound) the absence of blistering of the skin—all of these look so ideal that it is well to look for their disadvantages and limitations.

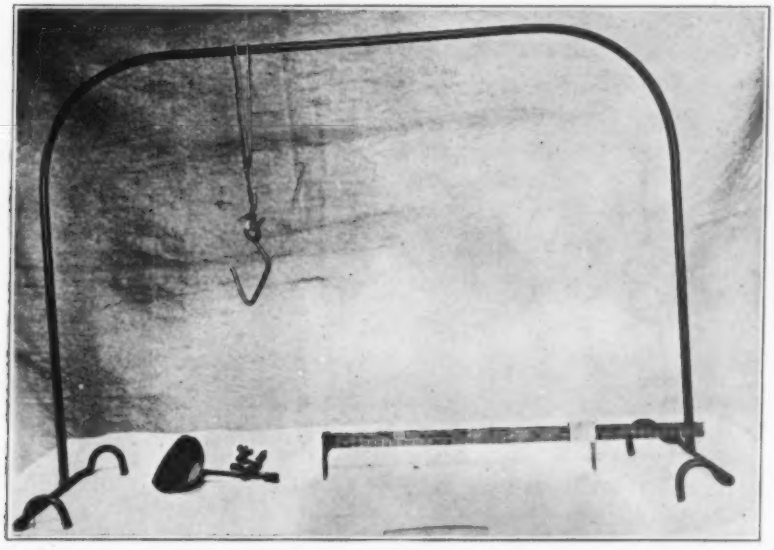

FIG. 6

(1) Pain is present for the first day or two, sufficiently to make it worth while giving a hypodermic of morphia gr. ¼ before giving the gas. In most cases there is no further pain worth mentioning and patients often keep their calipers on for 12 or 14 weeks and say they are hardly conscious of their presence. In a small

minority there is pain, even severe pain at some stage or other, and then generally due to some error of technique.

(a) Too small a skin incision causing a "pressure leucocytosis" and retention of a drop of sterile pus under the skin, movement of the skin will generally release this.

(b) Wrong placing of the points,—too far forward, where they have a tendency to slip further forwards or too close to the top of the adductor tubercle which seems to be a sensitive point.
If no cause can be found and pain is really severe gas should be given, calipers withdrawn, and a new pair inserted through fresh punctures half an inch higher up. As a general rule Caliper extension is much less painful than is glue extension.

(2) Penetration of the bone should not occur with this form of caliper furnished with a screw check-bar. In no case that we know of has there been necrosis.

(3) Sepsis, or rather the fear of it has been a great bogey. Anything more than the pressure leucocytosis above referred to does not occur and that is easily controlled. We have never seen any bad effects, but we have heard of one or two cases of penetration and infection of the knee joint where patients have been sent on long journeys with ice-tong calipers deeply in and unfurnished with a check-bar. Calipers in any form are unsuitable for transport purposes.

There is no difficulty about the healing of the wound when calipers are removed. It is generally closed and dry by the third day and remains so.

(4) Involvement of the knee-joint in the fracture is in our opinion usually a bar to the use of calipers, and for two reasons: distension of the synovial cavity by fluid lessens the space available for insertion of calipers and might cause risk of puncture of the joint; and also where there is sepsis in a splint between the condyles pressure of the caliper points towards each other would tend to shut in this sepsis.

Radiography should be very freely used and always done in the ward, using a portable trolley apparatus. In the first week or two this may be necessary several times; in later stages less frequently. Once in two weeks is a fair average throughout. A. P. and Lateral views serve well. The plates used are 12 x 6. From them, with the help of a reducing lantern and camera, a small positive print is made. These reduced prints are kept at the bed head of the patient, the series forming a radiographic history of the case as well as being a constant reminder of the nature of the deformity to be corrected.

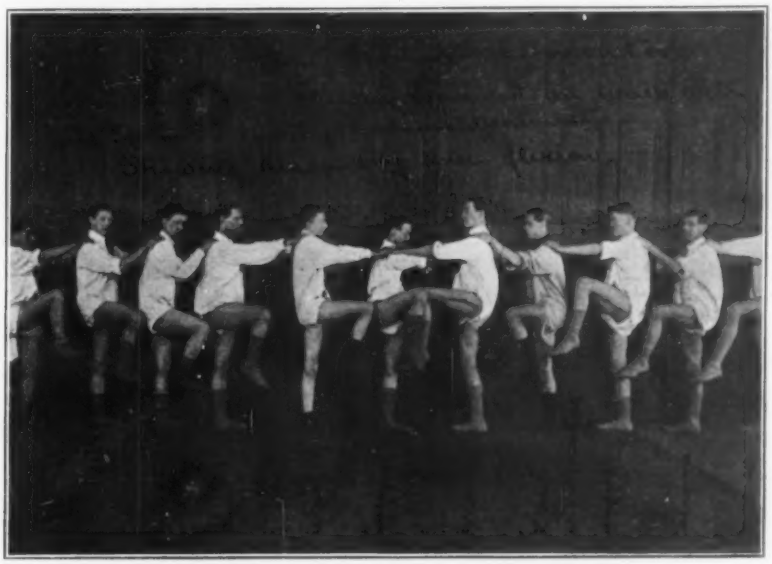

FIG. 7.—Splints Worn During Day.

EXPLANATION OF FIGURE 6.

The V shaped hook is used to suspend the ring of the Thomas splint and owing to the shape it grips wherever it is put and so gives some internal or external rotations of the splint if desired.

The measure graduated in centimeters and with a sliding point enables one to measure a femur more accurately and easily than with a tape and without disturbing dressings.

The screw pressure pad is useful to correct any bowing or bending of soft callus. It gets its attachment from the side bar of the "Thomas" splint, and is used in pairs very effectively.

Management of Fractured Femurs.

Success in dealing with these cases depends on two salient principles:

1. Team work.
2. Attention to detail.

In no class of case is the necessity for team work more in evidence than this particular class.

There are certain points which must be dealt with by the medical officer himself; others which are the prerogative of the nurse, others for the masseuse and still others for the orderly.

Each and everyone should be trained in his or her particular portion of the work. All ranks must appreciate the importance of delicacy of touch and movement; bumping against beds is sheer clumsiness excusable only in the very new hand.

In most cases the medical officer will be able to leave the dressings to the nurse and he should concentrate his attentions on the efficiency of his extension and the correctness of his mechanics as evidenced by the position of the opposing ends of the fracture and the length of the limb.

Into his sphere of action will crop up the minor operations associated with the opening of abscess cavities, the removal of sequestia and in late stages the plating of ununited fractures and perhaps suture of divided nerves.

The actual control of the fracture will entail a considerable amount of work on the part of the medical officer.

By inspection, palpation, radiography and measurement he will get complete information as to his success or otherwise in correcting the disability or deformity.

He will find that he will in many cases need to make gross alterations in the original position in which the limb was put. He will in most cases from day to day need to make minor adjustments.

These adjustments consist of increase or decrease of abduction, adduction, more or less flexion of joints, tightening of posterior slings, progressive use of pressure pads, attention to cord and pulley, etc., etc.

Unless the medical officer is prepared to give his undivided attention to these various points he is inviting failure to achieve the high percentage of perfect results which the system permits of.

THE MASSEUSE.

She will take her orders from the medical officer and these should be definite.

In a case in which extension is applied to the femur through the medium of calipers, her duties will be exactly defined.

She will massage the foot and leg up to the knee. The toes and ankle are to be freely moved actively and passively but on no account is the knee to be moved.

All the movements of the knee must be done under the direction of the medical officer. It may be that the knee is exactly flexed to correct the backward displacement of the lower fragment in a lower ⅓ fracture; it may be a simple case with calipers in position pulling on the condyles.

No matter what the case the medical officer is the only person to apply the principles of movement to that particular joint.

In late cases with fairly firm union and with no extension on the masseuse is given a freer hand. She may now move the knee within the limits of its freedom but no attempt to increase the range of movement by actual force is permitted. The methods of attaining a freer range will be described later.

In all cases without wounds above the knee a certain amount of light massage to the thigh is permissible at all times.

THE NURSE.

Apart from the actual attention to the comfort of the patient she will be given a large percentage of the dressings to do and there is a definite system on which the average dressing should be done.

The bed is constructed so that a moveable section may be let down under the wound with the object of facilitating the dressing.

1. Before this is let down the first duty of the nurse is to see that the ring of the Thomas splint is neither too far up the bed nor too far down. It should rest just on the lower edge of

the upper biscuit. If it is too far up the bed then the letting down of the section does not clear the field of operation as much as desired. Some of the thigh will be obscured by the upper biscuit. If the ring is too low then directly the section is let down the patient tends to sag into the opening and is only supported by the hook and cord supporting the ring.

2. Having attended to these details the nurse proceeds to the actual dressing. In all cases when calipers are applied the care of the points is the first portion of the dressing. It is a sterile operation and must be attended to before any other portion of the dressing is done. An alternative is to make the dressing of all caliper points in the ward a separate operation at a special time. The dry gauze soaked in 1 in 500 Flavine in spirit solution is applied round the points and changed every second day.

Should there be discharge round the points, a not uncommon complication, a little of the solution introduced through the needle of a hypodermic syringe passed along the side of the caliper point will control the discharge and in most cases get rid of it after a few applications.

Repeated examinations of this discharge have invariably demonstrated its sterility. It consists of polymorphonuclear lencocytes and fibrin.

In dealing with the actual dressing the guiding principle is the non-disturbance of the fracture. The limb is supported in three slings and in the vast majority of cases it is possible to approach the wound by letting one sling down without permitting the fracture to sag. Having irrigated and dressed the wound the sling is replaced and the other two can be released in turn to allow the adjacent skin to be attended to.

In the event of its being necessary to let down two or more slings at once, there is a simple device that gets over the difficulty.

If two narrow strips of pliable aluminium are taken they can be bent over the splint and under the thigh one above and one below the fracture so as to support the limb. The slings can then be removed without the fracture sagging and the narrow strips do not interfere with observation of and attention to the wound. This device is invaluable also for operating on the patient without taking off his splint or interfering with his extension. The whole dressing should be and is capable of being done

without movement of the fracture and with a minimum of pain to the patient.

Having completed the dressing the nurse then takes a prepared strip of calico boiled in soft soap, passes it between the rings and the skin and soaps the ring and skin by a to and fro movement. This device diminishes tendency to pressure sores.

The back is rubbed with spirit, the section re-applied and the dressing thereby completed.

THE ORDERLY.

The duty which needs to be explained to the orderly is that of the application of bed-pan to the patient.

For this purpose the sectional canvas and mattress is let down. The sound leg is bent up at the knee and the bed-pan is passed under and placed in position from that side. The canvas without the sectional mattress is then fastened up to support and keep the bed-pan in position.

The orderly should also familiarize himself with the use and application of the various parts of the apparatus. When requested to do so he should be able to assemble and erect the frame for abduction, to fit the knee flexion pieces to the splints of patients newly arrived, not forgetting the transferance of slings from the rigid to the moveable portion, the foot piece and chain. He should be thoroughly familiar with the method of transference of the patient from stretcher to bed or vice versa. An orderly who embodies all these assets will be found invaluable in the smooth running of a ward.

We have now to consider in some detail the late management of a case. When wounds are healed and there are signs of fairly firm union th calipers may be dispensed with. As to when this will be one, may not dogmatise but in the average case it should be about the end of the third month.

It was then our practice at one time to take the limb out of the splint and begin flexion of the knee over a pillow. This proved fallacious in its results. The extra latitude permitted to the patient by the removal of the splint while apparently desirable actually contributed most to the defeat of the end in view.

The pillow needed repeated adjustment. If the patient found it irksom he could and did slide it down to support the calf or turned his leg on its side. Worst of all it was found that in certain cases, the thigh unsupported, sagged backwards at the seat of fracture and the work of months was marred and to a certain extent nullified.

The method in short was rough, incapable of accurate control, inefficient and altogether unscientific.

The present method has been found to satisfy all the requirements.

On removal of the calipers it will be found that the knee has an effective range of movement of 25 to 30°. This can be increased to 90° in a simple way.

The arch at the foot of the bed is brought further up the bed and the rigid Thomas splint is cocked up on this like an anti-aircraft gun. This gives a greater range of movement to the flexion piece and this range can be increased from time to time by advancing the upward tilt. In this way a movement through an angle of 90° can be attained in ten days to three weeks time. It is an excellent device to tie a cord to the foot of the flexion piece, bring it up vertically, then through a pulley to the patient's hand. He can then passively move the knee himself. During this period the thigh is supported in its sling and any tendency to sagging thus prevented. Tendency to bowing can be controlled at the same time by lateral bandages or screw pads. The graduated tilting of the splint has the added advantage of flexing the hip more and more and thus restoring its antero-posterior movement.

The next stage is the fitting of the patient with the Thomas knee splint, unfortunately now called the walking caliper.

The wounds should be healed and the union of the fracture firm. The medical officer will have noted that during the several weeks while extension was not operating and the knee being moved, there was no marked tendency to shortening or bowing. He will by attempt at lateral bending obtain direct guide as to the firmness of the union. He will determine that the callus is plentiful and not tender to pressure and lastly he will note in the most recent radiograph the position of the fragments, the amount and distribution of the callus and most important of all its density or rather homogeneity.

A callus that is honey-combed and irregular no matter how profuse will not stand strain like a callus which is homogeneous in its consistency.

A history of prolonged sepsis is usually associated with the presence of honey-combed callus and in certain cases this will be found to have invaded adjacent muscles producing a local myositis ossificans and consequent disability.

Having satisfied himself that the patient is ready for a walking splint the medical officer will measure him as follows:

1. Circumference of thigh at level of Tuber Ischii.

2. Oblique circumference of thigh from Tuber Ischii on inner side to a point midway between the Crest of the Ilium and the tip of the great Trochanter on the outer side. The difference between these two measurements is usually from 2 to 2½ inches.

3. From Tuber Ischii to the sole of the heel.

These measurements are supplied to the splint maker. He adds a little to the last measurement to allow for the turning in of the ends under the boot and the modern adaptation of the splint has a sliding adjustment by which the splint can be lengthened or shortened to allow for shrinkage of callus or other shortening of the limb. This is liable to occur in the first few days and can thus be dealt with easily.

The patient should wear the splint during the day for at least three months. He should take it off several times each day in order to exercise his knee so that when the goal of his ambition is attained coincident with the discarding of the splint, he may walk with rigid bones and mobile joints.

N. B. One may use an ordinary Thomas splint with small ring. Measure to level of heel, allow one and one-half inches, so as to clear heel from heel of boot. Bend at this point.

The holes in the heel of the boot should be carefully placed. The one to the inner side should be about 1½ inches back from instep portion. The outer is about ½ an inch from the instep portion. This causes the shoe to point outward. The sole of the other boot should be raised one inch.

271 Cases Treated.
66 Still Under Treatment.

205 Results.

Average shortening for above, 0.48 C. M. on application of walking splint.

6 with an average of 5.7 C. M. shortening on arrival.

6 with an average of .4 C. M. on departure.

Calipers on 120 cases from beginning to end of treatment.

Average shortening at end, 0.5 C. M.

Walking Caliper worn an average of 60 days in those cases that had union in about nine weeks.

THE TIME ELEMENT IN RECONSTRUCTIVE SURGERY

By R. W. Johnson., Jnr., Baltimore.

The war has done an immense service to humanity in the enforced development of the reconstructive side of surgery, and has demonstrated to the profession at large its possibilities, of which only a few enthusiastic idealists dared to dream before. However, this small group of orthopaedic surgeons, led by Sir Robert Jones, has proved the practicability of first saving limbs and then making something of them. This ideal is now firmly established for all time and will apply to the industrial injuries of peace as well as to war wounds.

Reconstructive Surgery is orthopaedic in origin, principle, and guidance, and so has fallen heir to the methods and ideals of civil orthopaedics, which since it deals largely with children has been able to disregard time in pursuance of treatment. Also it is a new development and by its wonderful success has fired the enthusiasm of all who have practised it. But this very enthusiasm is a danger, for it may lead us beyond the limits of the soundest and fairest point of view in our consideration of the individual case. Therefore the danger of disregarding time is due to two causes—old habit and new enthusiasm. Consequently I feel that it must be doubly emphasized, and since I have been made to experience personally as a patient the importance of time consumed in treatment as well as to see the part it plays in the lives of my patients, I trust I may be pardoned if I make the brief for its consideration a strong one.

It is axiomatic that reconstructive surgery to be successful must be careful, thorough, and very often gradual and slow. We cannot afford to be hurried by our own impatience or the temporary discouragement of the patient. We must take *our* time, but we must also remember we are taking *his* time. Our first consideration should be "What can be done for this man's disability?" but our second should be "How long will it take to do it properly and carefully?" Those questions the surgeon can answer from his professional knowledge and experience, the first in terms of physical improvement reckoned on a percentage basis, the second in terms of days or months of (a) Hospital in-patient treatment,
(b) Out-patient treatment.

That will suffice for the injured limb itself, but reconstruction deals with the man as a whole, not with an isolated part of his body. To deal with the man it is not enough to be a good surgeon; one must be something of a political economist, since the man's earning capacity is at stake; a bit of a psychologist, since the man's morale is involved, etc. In short the reconstructive surgeon must be a man of "understanding" who is prepared to be the guide, philosopher and friend of the patient. To be this he must appreciate fully the factors in the patient's life which give the Time Element its importance.

A. FACTORS.

(1) First in importance is the *End Result* aimed at by the proposed treatment. This must be carefully determined, and a fair estimate on the percentage basis must be made as to the improvement to be expected, judged purely by the standards of function, occupation, earning-power, and ability to seek pleasure and recreation. Then we must consider the surety we have of getting the expected result. In some cases this will be 99 to 100%, in others 50%, and so on, and to be fair we must modify the first percentage estimated in proportion to the surety. With these two estimates made we have an End Result fairly determined to offer the patient. The physical improvement is so great in the vast majority of cases that it outweighs all the other factors and justifies many times over the time spent to obtain it—for instance tendon transplantation done in irreparable Musculo-Spiral nerve lesions of the middle third of the arm.

(2) Then comes the question of *TIME*—pure and simple—days, months, even years of the patient's life to be consumed in treatment.

(a) In children this factor, as well as most of the others discussed, may be almost entirely disregarded because growth, education, etc., can go on without appreciable curtailment.

(b) In the young adult the question becomes a real one. Time spent in treatment is partially wasted. It must be estimated for each case, from observation of the patient and the environment how much use he can and will make of his life during the period of his treatment. At this stage of a man's career the time consumed is immensely more valuable.

(c) In the thirties and early forties we are taking part of the most productive years of a man's life, a time when, if he is married, his family is most dependent on him as a wage-earner and head of the home. Unless then the fruits of treatment are soon realized he begins to enjoy them only when his strength and powers make him less able to profit by them.

(3) *Condition of Life.*

(a) Personal and Family. A single man is more justified in exchanging time for physical improvement than a married man, who must consider the support and upbringing of his family, and the surgeon must take into account not only the man, but also the whole family circle involved.

(b) Financial. This question is a civil one, for in military or industrial cases it may be neglected as part of a man's life, except as it involves his future earning capacity, which subject will be discussed in the next paragraph. In civil life it is a real problem, not only for the man but also for the surgeon, the hospital and the State. In cases of wealth it is easy, but for the middle and laboring classes it is a tremendous and oftentimes insoluble problem. It is one of the failures of the present civilization that a cripple may not be able to afford to undergo curative treatment. That is a problem outside the surgeon's field, for he frequently enough does "charity cases", and it remains for society to right this wrong. The surgeon can only consider it as it applies to the individual case, and urge it on the conscience of the community.

(4) *Occupation.* This is always considered strongly in the plan of treatment, but do we think of it enough as regards time? For example, is it always wise to spend valuable time working over a more or less useless leg, when it might be much better applied to learning a new and possible trade, since a change of trade may have to be made eventually in such a case?

(5) *The efficiency of mechanical substitutes or aids to accomplish the lost function.* For instance the hand is worth infinitely more time than the foot, as the artificial foot is a fairly efficient substitute while the artificial hand is a poor contrivance at best.

(6) *Hospitalization or production of chronic invalidism.* This is, to my mind, the most insidious evil of prolonged treatment and the one most difficult to combat. Treatment must, by the nature

of things, be long and tedious, and if the time passes quickly for the surgeon it drags wearily for the patient. We all know, only too well, the expression "fed up". In reality the man who is "fed up" is the one who is least hospitalized. He is the man with native energy and ambition whom hospital life and routine have stifled and suppressed. That man, while he is the hardest to treat, can stand it the best, for when he gets out he will soon regain his keenness and energy. His mind has kept partially awake by its rebellion against the one-toned environment. He will be glad to get back into the struggle with a tangible world, partially disabled though he may be. His mind may be rusty, his muscles flabby, his fingers clumsy through lack of practise at his trade, but he has not lost his nerve, his ambition or his love of contest.

There is another type and a common one, the patient, long-suffering, but listless man, who earns the reputation from the sisters of being a "fine patient." That he is, but he is likely to become more or less of one for the rest of his life. The phlegmatic, lazy, easy-going types run grave risk of being permanently hospitalized. They lie in bed for four or more months in many cases, are waited upon for every want, read trashy books if any, but chiefly gaze idly at the ceiling or talk trivialities with their companions. Then comes a long period of walking convalescence with at most 1 to 1½ hours treatment, massage, etc., to occupy them, and the rest of the day is spent in idleness. Aside from the pain and strain of such long treatment, the ennui has so eaten into the very fibre of the man that it is problematical if his ambition or energy will ever return to their former pitch, and a certain proportion never have the courage to face the world with their remaining disability plus the engrafted habit of idleness.

I have barely touched on this hospitalization phase of the Time Element, for it is the most indefinable as well as the most insidious, but to one who has gone through it, it seems to be as dangerous as it is likely to be overlooked.

(7) The last factor involved in prolonged treatment is the *General Health.* This applies chiefly to septic cases, but it is just this type of case with which the wards of the hospitals are now crowded—old compound fractures. There is a period in the history of many of them when the die must be cast for conservatism or radicalism. Early, the saving of life is almost the only indication for radicalism. Later, when time has shown what sort of a

course such a case is likely to run, the ways of conservatism and radicalism divide and a decision must be made as early as possible as to whether the end result will justify the conservative course. Then it is that the Time Element comes to the fore as a factor which should influence the decision. If the prognosis is distant we must consider the effect of the prolonged sepsis on the general health. There is absorption from the best drained of bone cavities, minimal but nevertheless toxic, and when one is faced by the possibility of recurring deep abscesses, burrowing pus, and other conditions giving rise to sudden increase in the absorption of these toxins, there is good cause to fear for the effect on the general health. In joint infections this is particularly true, and in these cases conservatism must face the question of Time in relation to general health and justify its course by showing decided benefits to be gained thereby which outweigh the risks.

(8) *Pain.* The effects of pain are so intimately connected with general health that they must be considered with it. When we recommend prolonged treatment we often ask the patient, in other words, to undergo a considerable amount of unavoidable suffering, pre-operative, post-operative, from the dressing of septic wounds in certain cases, massage and mobilization, etc., extending over a long period, and that pain, both in its intensity and especially in its duration, tells on a man, tells on his endurance and his reserve. That pain, which we ask the patient almost glibly to undergo, must be examined in the light of the Time Element, and the amount of benefit, eclipsed by the shadow so cast, must be deducted from the valuation of the end result.

B. Having shown above the very real value of Time in its various ramifications, and having pointed out some of the subtle dangers to the patient of prolonged treatment, let us turn to how these disadvantages may be avoided, or at least minimized.

(1) *The short cut of Radicalism.* This is a course which is the solution of the problem too frequently for the general surgeon, but too seldom, I fear, for the reconstructionist. I can recall several cases, with through and through septic wounds of the tarsus, which would be walking more comfortably today had I sent them out with a good Syme's stump instead of spending 8, and in one case 11 months, overcoming sepsis, and in the end getting a foot, with moderate mobility it is true, but which will give pain on even slightly rough ground and which will act as a barometer to

the man for years to come. Yet those feet were always just tempting enough to make me avoid the sacrifice, and I must in all honesty confess that I charge myself with the waste of the extra months of the men's lives spent in saving their feet. Septic excised knees, where infection of the cancellous bone ends is well established and chronic, I have given up wasting time over as a rule, for in the end I have found that the man rejoices in a painless stump and pylon, after months of discomfort in plaster and pain in trying to walk with a caliper.

(2) *Conservatism.*

(a) *Without proper organization and equipment.* This is fraught with the grave dangers of hospitalization and can only be truly successful when the time is relatively short or the benefit expected is proportionately large. It is not wise in the borderline case, for hospitalization quickly counterbalances an improvement of only moderate degree. Also if the patient is under treatment for a long period without the aids of workshops, etc., he quickly goes stale, loses interest in his condition, and then the surgeon is at a grave disadvantage, for unless he has the active, eager co-operation of the patient he will fall far short of his intended goal. The will to get well, and the concentration of effort and attention of the patient are as essential to good results as skilful treatment.

(b) *With proper organization and equipment.* This is true *reconstruction* as distinguished from reconstructive surgery, and as yet I do not think we have quite attained the utmost in it. When we have attained perfection the importance of the Time Element will have almost reached the vanishing point, and already in the Military Reconstruction Hospitals it has been minimized by the workshops, bedside occupations, etc.

I wish to pay a tribute to those who are responsible for the initiation and organization of the workshops at these Military Reconstruction centres. I have had charge of a group of beds both before and after the establishment of a workship, and I can truly say that the improvement in the general happiness and contentment of the men, and in their morale has been unbelievable. The men take more intelligent interest in their disabilities and help the surgeon and staff more effectively in overcoming them, and very rarely refuse operation. The direct curative side of the shops is immensely valuable, and in such an occupation as basket-making

for injured and stiff hands it is inestimable. However to my mind the vitalizing feature of the shops is their greatest service, for it applies to every case employed. The men are busy and consequently happy. They are interested and so kept keen, active, and prevented from getting slack. This in prolonged cases is really almost half the battle won, for the surgeon, so he must be appreciative of the help so given him. The third feature of the shops is purely reconstructive, in that they offer an opportunity to the man deprived of or handicapped in his own trade by disability, to learn a new and oftentimes better trade which he is able to carry on.

The above applies only to the upcases, and consequently we must sharply distinguish between these and the bed cases as regards time. Time spent in bed is very devitalizing, despite all the efforts made at present to stimulate interest in the bedside occupations of embroidery, knitting, etc. These help, but since they are not naturally congenial occupations for a man they fall far short of doing the good that carpentry, iron or leather working, etc., do. Also, being largely feminine in character, they have the psychological effect of making the man feel hopelessly disabled as a *man*, and this is bad. We must keep up the patient's interest in the outside world that he knows, and this can only be done by personal attention. Each case should be made to feel right at the beginning of treatment that a special person is taking an interest in him, from the social and economic point of view as well as the purely physical. He feels oftentimes, perhaps rightly, that the surgeon or sister is not the one for this. He should have someone else with whom to talk over at length the special problems of his life and home, and who can give advice as to the future and show him how to help keep himself keen and alive even though confined to bed. A social service worker would find this a congenial task, and could be of inestimable help to the surgeon, in presenting to him sidelights on the patient's general situation and problems which might otherwise escape his notice. This need has been recently supplied in British Military Reconstruction Hospitals in the person of an Education Officer, who will be able to do much to keep the patient in touch with his world and to supply congenial bed occupation and appropriate reading matter. Thus the man will have no time to fall into a rut of inactivity of mind as well as body but every possible moment will be utilised, either in refitting him for return to his former place in life, or, if this is barred, by starting him on

his road to a new and perhaps a better station. We must establish a liaison between the patient, the surgeon, and the outer world to get the best results of treatment for bed cases. The ideal of reconstruction is to return the patient to a work-a-day world as fit as possible to meet its requirements. This we cannot do by making our reconstruction hospital a cloister, but by modelling the patient's life in hospital as nearly as possible on his life outside.

C. These are the general lines by which we can minimize the value of the Time Element, but let us look somewhat more closely at the possibilities offered for this in the various types of reconstruction.

(1) *Military.* This comes first, as the largest group at the present time. It is the duty and privilege of a grateful nation to reconstruct its wounded soldiers as far as it can. Also it is sound economy to restore men and cut the pension bills, at the same time increasing the economic value of the citizen. Consequently, we who are in khaki are fortunate in not having to look at time in the light of finance. It is very fair both for soldier and surgeon. The result is, however, that both surgeon and patient must guard more strongly against hospitalization. We must no more allow the deserving wounded soldier to be hospitalized by over enthusiastic reconstruction than the poor to be pauperized by over benevolent charity.

We now have splendid workshops, but much more could be done to improve the effectiveness of these. The Medical Officer could and should keep more closely in touch with the workshops, instead of just vaguely telling his patient to report there for work. The old army habit of "swinging the lead" is strong even in the wounded soldier and sometimes the man "messes about" in the shops, rather than really works. This tendency can be counteracted best by personal interest and supervision combined with discipline tactfully maintained by the N. C. O. and instructors. Our ideals are high, but we feel that it is practicable to get still more good out of the shops than we do now.

Then as to the bed cases we fall down rather badly at present and the hospital staff are too overtaxed with care and nursing to have time to help much. May I suggest that this is a big opportunity for the Y. M. C. A. and kindred auxiliary services to do good constructive work. They have a personnel of trained workers, teachers, lecturers, etc., who could do much to brighten the

lives of the bed cases and revive their interest in things outside the hospital and their illness. A closer co-operation by the Ministry of Labour or Labor Organizations in helping us to refit men and advising them authoritatively as to opportunities open to them, would be of real value.

(2) *Industrial.* Industry is in a much more difficult position than the State for two reasons. (1) The number of injured is smaller, so that elaborate staff and equipment is not practical. (2) Expense of maintaining men in hospital for long periods is too great. Industrial Insurance has done much to encourage reconstruction, and at present many of the larger corporations have grasped the idea, but the shorter-sighted policy still frequently persists. Reconstruction may seem expensive, but if a good economy to the State why not to the corporation? It lessens damages, increases good-will, decreases pensions and makes it possible to re-employ the man in some other capacity. More careful consideration must be given to the Time Element in Industrial Reconstruction than in Military, for its economic soundness must be clearly established before the procedure is undertaken. The surgeon cannot indulge in "good surgery" at the expense of either employee or employer.

I should like to suggest that time is best saved by limiting inpatient treatment as much as possible, and by having the corporation supply a counterpart to the Military Curative workshops by re-employing the man at part time in some job which he can carry on but which will leave him time to pursue the later stages of treatment. To do this there must be complete co-operation between the surgeon and the administration, but as its results will be beneficial both surgically and economically, this ought to be possible and practical.

(3) *Civil.* This is perhaps the most difficult of all. The average civil hospital fights shy of prolonged cases as occupying valuable bed accommodation. The result of this has been that children with orthopaedic troubles are cared for in special hospitals maintained by State or charity. The same must be true of the reconstructive cases. It is an economic asset to the State to have its cripples rehabilitated as far as possible, and this work should have ample State support. In the near future when various Military Reconstruction Hospitals have completed their function, there will be a wonderful opportunity for the State to acquire excellently

equipped plants for carrying on the same work for the civil injuries. This should not be overlooked, for with the spread of the knowledge of the possibilities of reconstruction the civilian who is injured is not going to be content with a half-way patching up.

The same valuation of time applies to civil as well as industrial and military patients, and the same remedies for the dangers of hospitalization are possible. Employment while in hospital is essential here too, and the system of workshops now in force should be applied later. These will be expensive in one sense, but in another sense they should be economical, for they are productive not only of useful articles, but also of improvement in the patients, and they certainly do decrease the length of treatment required. A well organized social service to meet the problem of the bed cases, and to act as liaison for all in putting them in suitable position on discharge is most urgently needed. It could work along the same lines as the "follow up" work in large tuberculosis clinics. In any case there must be no more sitting about the ward in dressing gowns and slippers in the reconstruction hospitals, large or small, civil, industrial or military.

CONCLUSIONS.

(1) Time is necessary for conservatism and reconstruction.

(2) Time is valuable to the patient in many ways, to the State or employer as a financial consideration, and therefore cannot be invested without adequate return improvement.

(3) Time spent in prolonged treatment is dangerous to the patient.

(4) Therefore improvement must be greater, the greater the time involved.

(5) The dangers of time must be minimized by:

- (a) Reduction to a minimum of confinement to bed.
- (b) Keeping the patient in touch with the world of his normal life even though he is in bed, through personal interest and appropriate occupation, reading, lectures, etc. Maintenance of mental tone throughout course in hospital.
- (c) Adequate employment in workshops for all up cases.
- (d) Re-education and vocational training in certain cases.

Correspondence

To the Editor of The Journal of Orthopedic Surgery:

Dr. Kleinberg's article on tuberculin in the December number of the Journal deals with a subject of such importance as to deserve critical thought. The author's condemnation of tuberculin as a therapeutic agent is given additional weight by the high standard of his previous publications and his reputation for intellectual honesty. For many, his experience would set the seal on the fate of tuberculin. This tone of finality is my chief objection to Dr. Kleinberg's paper. It is of course perfectly possible that tuberculin in his hands, has been of no value, but his experience does not preclude the possibility of its effectiveness when administered by some one else. In other words, despite Dr. Kleinberg's unfavorable experience, tuberculin therapy ought not to be considered a closed book and I for one am willing to take up the cudgels in its defense.

Until the winter of 1919, I had never seen any encouraging results from its use; in fact, the numerous reports of American, English, French and German observers had all inclined me to distrust it. Last year, however, I saw several cases which compelled me to think of tuberculin seriously. The first was that of a boy of thirteen, whose mother gave me the following history: eight years before the right hip showed evidences of tuberculosis. Despite treatment by a well trained orthopedic surgeon, the disease progressed, sinuses formed and later the right knee became involved. There were, after two years, seven discharging sinuses and the boy gradually wasted away to a living skeleton. His parents, people of wealth, spared no expense in trying to secure aid for the boy and he was seen by several of our best orthopedic surgeons, all of whom gave a poor prognosis. He was constantly, during this time receiving thorough treatment according to our accepted standards. At this critical juncture, five years ago, tuberculin therapy was begun. Within three weeks the boy's appetite had returned and within three months all seven fistulae had closed, never to open again. At the time of my examination I found the boy unusually well developed and entirely without evidences of active tuberculosis.

On the strength of this experience, I selected the severest case of tubercular infection under my care as a suitable test for the tuberculin treatment. The patient, a sixteen-year-old girl, had a left-sided coxitis with three sinuses discharging foul pus, one of these opening into the anus; in addition there were evidences of tubercular peritonitis,—diarrhea, marked abdominal distention due to fluid, and a well developed caput Medusae. The tubercular infection had been present for about five years and the child had been treated at numerous clinics and hospitals without any improvement whatever. After six months of tuberculin-vaccine therapy all sinuses have closed, the abdomen looks almost normal, the child has a good appetite and is able to attend school.

These are but two instances of about thirty which have come under my observation during the past year. It is always a difficult matter to gage the value of a therapeutic agent, since we all tend to fall into the fallacy of post hoc ergo propter hoc, and yet when I consider that in most of these cases the previous treatment, thoroughly and conscientiously given, had been ineffective, whereas after the tuberculin-vaccine treatment had been initiated the improvement occurred within a short time, it seems to me only fair to give credit to this particular agent.

I for one intend to try out tuberculin still further, despite Dr. Kleinberg's condemnation and I hope that some others will do likewise. Its administration is not easy, and one careless mistake is liable to most unpleasant consequences. When there are mixed infections it should invariably be accompanied by the administration of an autogenous vaccine. It is scarcely necessary to add that thorough orthopedic treatment should not be relaxed because of the administration of tuberculin.

For further details of tuberculin treatment, I should refer the reader to Dr. Bonime's book entitled "Tuberculin and Vaccine in Tubercular Infections."

I wish in conclusion to acknowledge my indebtedness to this work, as well as my personal indebtedness to Dr. Bonime, who has helped me by the stimulus of his own enthusiasm and by his constant readiness to advise me and correct my mistakes.

LEO MAYER,

140 West 79th Street, New York City.

To the Editor of the Journal of Orthopedic Surgery:

Doctor Kleinberg's article in your December issue merits attention since it deals with a subject, the literature of which is rather scant. For the very reason that the article is one of the few dealing wih this very important subject and is likely to shape opinion in the minds of your readers, it is of the utmost importance that the statements made should be beyond reproach and without prejudice.

I do not question Doctor Kleinberg's experience with his own cases in the use of Tuberculin, though to one experienced in the methods devised by Doctor Bonime and used for years at the Polyclinic Hospital, his failures can in a large measure be understood; but when he attacks this method and claims from personal knowledge to have seen no results in the Polyclinic Hospital Tuberculin Dispensary, his statement can not be permitted to reach the profession without being challenged.

My authority for taking this task upon myself lie in two and one-half years' work in the Tuberculin Dispensary of the New York Polyclinic Hospital which has given me a fairly complete knowledge of Doctor Bonime's Combined Method of treatment of Tubercular Bone and Joint diseases, and a good opportunity to estimate the results obtained.

First, I want to point out the fact that the majority of the cases reaching the dispensary were chronic cases which might be called "Orthopedically hopeless," since they had had Orthopedic treatment for years in hospitals and in other clinics without results, and I can state from personal experience during these two and one-half years' that fully 90 per cent of these cases have been cured by Doctor Bonime's Combined Method, and not one have I seen that has not been improved. Now, wherein lies the great gulf of difference between Doctor Kleinberg's statement of his observation at the Polyclinic dispensary and my statement?

Doctor Kleinberg states that Doctor Bonime considers his cases of Bone and Joint Disease cured when they can take pure Tuberculin without reaction. This statement falls short of the absolute truth. Doctor Bonime lays stress in his book and in practice, upon the fact that Tuberculin alone is not sufficient to attain a cure. In addition to the use of Tuberculin to check the progress of the tubercular process, it is necessary to eliminate the mixed infection, which

is always found in open cases with sinus complication, by the use of vaccines and to eliminate the sinuses themselves by the use of Bismuth paste. More particularly does he lay stress on the point that blind pockets are a source of trouble and ultimate failure of cure, unless a counter opening is made and drainage provided, so that Bismuth paste can be used.

Sinuses often persist long after the course of Tuberculin is completed. Very often, in long-standing cases, Nature herself has eliminated the tubercular process and the mixed infection alone is rsponsible for the continued evidence of disease. A sequestrum is usually behind these persistent cases, but the use of Bismuth paste eventually loosens the sequestrum and forces it to the surface. Then healing promptly takes place. The accesory measures to Tuberculin Therapy, therefore, are frequently of equal importance with, if not more important than Tuberculin immunization, and without the combined method these cases can not be cured.

The conception of a cure at the Polyclinic Tuberculin Dispensary includes, not only complete Tuberculin immunity, but also a complete healing of all sinuses and blind pouches as demonstrated by the X-Ray, and absence of recurrence for a period of two years after the completion of the course of treatment. It is insisted upon that the patient return every three months for a period of two years for Tuberculin tests; and only after the eight quarter yearly tests show a continued absence of hypersusceptibility and no evidence of recurrence of the disease, is the patient considered and declared cured. In connection with this point, it is an interesting commentary on Doctor Kleinberg's observations at the Polyclinic Tuberculin Dispensary, that it has been my privilege and opportunity to have given some of these tests to some of the very cases which were under treatment during the time of Doctor Kleinberg's observation and to have pronounced them cured.

Doctor Kleinberg cites one case where the patient reacted with the next regular dose by a temperature of 104° followed by a relapse and ultimately death. Doctor Bonime's method of Tuberculin administration is based on the now well-known principle of slightly increasing dosage somewhat similar to that used in anaphylactic desensitization. If this method is accurately carried out, it is biologically impossible to have no reaction with one dose and a violent one with the next succeeding increase. No method is fool-proof

however, and we find occasionally in our Dispensary, particularly when a new Clinician is put on, that an error is made in the dilutions, or bottle No. 1 is taken up where No. III or IV is intended and so we get a severe reaction. It is more than likely that some such mistake was responsible for the unfortunate experience of the case cited by Doctor Kleinberg.

Dr. Kleinberg's six conclusions contain in them the reasons for Dr. Kleinberg's failure and the evidence that his six months' tutelage under Dr. Bonime had failed to give him a full grasp of Dr. Bonime's methods. He states:

1. Tuberculin does not cure tuberculosis of bones and joints.

This is true in a sense. Tuberculin alone, without the treatment of the mixed infection with vaccines and the sinuses with Bismuth paste, and particularly the care of blind pouches, does not cure the symptom complex of bone and joint disease.

2. In the majority of cases, tuberculin therapy causes no noticeable beneficial influence over the bone or joint lesion.

This is Dr. Kleinberg's statement. Three are many X-Ray records in the files of the Polyclinic Tuberculin Dispensary to prove conclusively otherwise.

3. In a small percentage of the cases there is improvement of the lesion.

An admission which is acceptable, but must be greatly amplified to meet our experience.

4. In some cases there may be distinct aggravation of the disease.

This observation is based on the single case mentioned by Dr. Kleinberg. A suggestive explanation of this case has already been offered.

5. New abscesses may appear during and after completion of the Tuberculin treatment.

True, if blind pockets are not counter-drained and treated. Nature will always force an accumulation of broken down tissue to the surface and expel it, regardless of tuberculin or any other kind of treatment.

6. Relapses occur after apparent improvement.

Which indicates that Tuberculin is a valuable agent in the

treatment of Bone and Joint disease, because, even when used wrongly, there is evidence of some improvement.

In conclusion, the records of the Polyclinic Tuberculin Dispensary are open to any one who wishes to investigate the truth regarding results obtained there in the treatment of bone and joint diseases. Many cases, in all stages of progress are under treatment at the present time (at the West Side Dispensary while the Polyclinic Hospital is still in the hands of the U. S. Army) and can be seen by anyone interested enough to investigate.

Most sincerely yours,

M. L. LANDMAN,
Chief Clinician Under Dr. Bonime.

Current Orthopaedic Literature

THE TREATMENT OF WAR WOUNDS OF THE JOINTS. By Professor Pierre Duval, Paris, France. *Surg., Gynec. and Obst.*, September, 1919, Vol. XXIX, No. 3.

The radical change that has taken place in the surgical treatment of wounds is due to two related causes: First, the fact that the joints resist infection, and second, the adoption of the practice of operating as early as possible in the lines. For practice of late operation and simple drainage, was substituted immediate operation and complete closure of the joint.

Immediate suture is based on the following principles: A war wound is contaminated directly by germs which are carried into the wound by shot and fragments of clothing. Infection developes but the defensive reaction of the synovial membrane is much more efficacious than that of other tissues; the synovial membrane seems to possess a bactericidal power. If a wound is examined bacteriologically a few hours after receipt, the usual bacteria are found in the skin, the muscles and the aponeurosis. The tissues and clothing contain a great number of bacteria. If the bones have been injured the surfaces of the fracture are contaminated and the edges of the torn synovial membrane are also contaminated, but the synovial fluid, the blood and serum are without bacteria. This aseptic state of the synovial membrane persists for a relatively long time—24, 48 and sometimes even 60 hours—before the septic arthritis develops. An appropriate operation permits the excision of all the contaminated tissues including bone tissues, the resection of the contaminated edges of the synovial perforation, the removal of all foreign material—the bearers of infection—that is, when the surgical wound and the joint cavity are aseptic, that complete suture without drainage should be done.

In wounds of the soft parts, in the edges of the perforated synovial membrane, on the shot and fragments of clothing and on the fractured bone surfaces, germs may be present, but the joint fluid is without bacteria.

Total immediate resection must be done only to smooth out very serious injuries of one or both bones of a joint when the injury itself has really accomplished resection.

In war wounds of the joints the utmost must be done to save the limbs. If through misfortune the functional result is bad, a secondary economical resection can be done at a later period.

In 1917 and 1918, the surgical treatment of war wounds of the joints was based on the following principles:

1. Operation as soon as possible.
2. Removal of all foreign substances; total excision of the track of the missile.
3. Careful cleaning of fractured surfaces, complete suture of joint without drainage.
4. Active and immediate mobilization.
5. Preservation of parts to as great an extent as possible, immediate resection being limited to injuries with extensive comminution.

The technic varies with each case according to the location of the wounds of the soft parts. As a general rule there are two methods of procedure: (1) treating the peri-articular wounds first, gradually proceeding to the joint and (2) treating the joint injury first and then treating the peri-articular wounds.

The arthrotomy incision must be ample; for the elbow, external lateral incision, internal lateral and the mid-line posterior incision for the posterior wounds. To expose the joint clearly the author always practiced section of the external lateral ligament which permits opening the elbow-joint widely, jerking the forearm toward the inside. This section formed in this way followed by well executed reconstructive suture dotes not compromise the function of the elbow-joint.

For the knee, two methods are in use: The U arthrotomy with section of the patellar ligament and the unilateral or bilateral arthrotomy.

The U arthrotomy must be reserved for extensive wounds of the bones as well as for posterior and intercondylar wounds, for it alone permits in these cases the right treatment of bone surfaces. For posterior wounds or wounds of the popliteal space with deep seated injury to the condyles or of the back part of the tibia, U arthrotomy alone permits proper treatment of bone injuries. For lateral wounds of the condyles of the femur or the tibia, in lateral wounds of the patella and in simple perforations of the synovial membrane, the large unilateral or bilateral arthrotomy is the method of choice. Transpatellar arthrotomy is not suitable for fresh war wounds of the knee. At the ankle, shoulder and wrist, the incision varies with the size of the wound.

The treatment of limited bone injuries is the capital point of the technique. Limited injuries in which there are fragments of shell are treated by ablation of the foreign bodies and careful cleaning of the joint cavity. Bacteriological observation shows that, after cleaning, the bone tissue is without bacteria.

The bone tissue infiltrated with blood must not be cleaned too vigorously. When one operates at the most opportune time, that is 8 to 12 hours after receipt of injury, the cleaning must be superficial. An important question to decide is whether a bone cavity which continues to bleed more or less should be left open in the joint. When the bone injuries are lateral and at the same time are extra articular or intra-articular, by proper suture of the synovia the cavities are separated from the joint.

When the bone injury is complicated by the presence of fissures more or less extensive the treatment must be the same as for all fractures. After scraping the center of the fracture the fissures must be opened with a lever of any kind so as to scrape the walls of the fissures; then the bone fragments thus displaced must be replaced. If the bone fragments cannot be correctly maintained in place so as to re-establish the joint surface as much as possible, one must resort to nails or screws. This must be done in injuries to the condyles of the femur, tibia and humerus, or of the deep part of the patella.

Once the joint is well cleaned we have a surgical aseptic wound and the operative procedure must be the same as for a closed fracture of a joint.

The most important result to be obtained is the re-establishment of a normal joint outline. Experience has shown that good functional results can be obtained even when there is a partial loss of joint surface if the general outline of the joint surface has been preserved.

The treatment of perforations of the synovial membrane is important. Edges of the synovial aperture usually are bruised, lifeless from traumatism and contaminated by bacteria from the wound. It is necessary to treat them by excision and then by suture.

The treatment of the serious fluid in the joint is most important. The serious liquid must be dried up as completely as possible with dry sponges in all parts, so as to leave neither blood nor fibrinous coagulum.

Up to 1918, before placing the last suture, almost all surgeons poured ether into the joint and rubbed the surface of the bone with a sponge saturated with ether. By degrees this antiseptic treatment has been abandoned and joint surgery has become purely aseptic.

The terminal suture is made layer by layer, preserving as much as possible the ligamentous, fibrous and muscular planes periarticularly. No drainage is used.

War wounds of joints are frequently accompanied by extensive muscular peri-articular destruction. It is most important to repair grave injuries to the important muscles. There are two muscles for which this repair is of first importance—the arm triceps and the high quadriceps extensor.

Active immediate mobilization of joint injuries insure ultimate perfect functional results even in cases of comparatively extensive bone destruction. Twenty-four or even thirty-six hour's after injury joint surgery may be applied.

All injuries to joints must be treated according to these general principles. In the hip only it is thought advisable to do resection directly. At the elbow, wrist, shoulder, knee and ankle, aseptic and highly preservative surgery gives extraordinary results.—*Leo C. Donnelly, Detroit.*

PENETRATING INJURIES OF THE KNEE JOINT. H. C. Mitchell. *Illinois Medical Journal*, 1919 XXXVI, 255.

The author from his experience in railroad and mining surgery, sets forth some good points in surgery of the knee joint. The past five years have given much to our knowledge of knee injuries, and, while previous to this time, a severe infection meant amputation or a stiff knee, we are now able to preserve motion in a large percentage of such cases.

The method of drainage is probably responsible for the good or bad result in most instances. We have learned to avoid the synovial cavity in placing our drains. When drainage is necessary it is best to suture the edge of the synovia to the skin in order to establish an outlet, or to place a drain down to, but not into the synovial cavity.

In past years, as far back as the Civil War, injuries to the knee, especially gun-shot injuries, gave a mortality of 60.6 per cent. In the Spanish War this was reduced to 6.5 per cent, and the Boer War to 4.2 per cent.

The necessity for immediate immobilization in penetrating wounds of the knee is emphasized. A case is reported in which the author was called on to do a complete arthrotomy to extract a nail from a knee joint, which at first partially protruded but had completely disappeared inside the joint during the journey, without immobilization, from the scene of the injury to the hospital.

In cases of small steel fragments passing clear through the joint, or lodging in the lower femur or upper tibia (not in the joint), all that is necessary is to immobilize completely for a week or ten days. Accumulation of fluid should be aspirated and examined for organisms.

If the foreign body has lodged in the joint it must be removed. The operation should be preceded by accurate localization with the X ray. The surgeon should never grope blindly for a foreign body in the knee joint. A good practice to follow is to "see well what he does and do well what he sees."

Penetrating wounds with infection and extensive joint fracture require extension of the leg to keep the joint surfaces well separated to establish adequate drainage. If either condyle is torn away it is better to excise the joint.

Amputation is indicated in cases of "extensive laceration of the soft parts and injury of the blood vessels, or beginning gas gangrene with extensive fracture accompanied by severe infection."—*William Arthur Clark.*

THE CONTRIBUTION OF THE WAR TO THE SURGERY OF THE KNEE-JOINT. By Burton James Lee, M. D., of New York. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

Willems' treatment of a wound of the knee-joint may be briefly outlined as follows:

1. Accurate foreign-body localization.
2. Careful debridement of all soiled and devitalized soft tissues and soiled bone.
3. Removal of all loose bone fragments and foreign bodies.
4. Irrigation of the joint with saline.
5. Filling of the joint with ether.
6. Primary closure of the joint by suture, usually including the skin. With considerable injury to knee or muscle, it is wiser to close the joint capsule, but leave the skin and muscle unsutured.
7. Early and frequently repeated active motion of the knee, no splint being applied, save with massive bone injury. This mobilization is begun upon the second day and is continued at two- or three-hour intervals. The patient is up and about the ward, with crutch support, on the fourth day, and is encouraged to walk without any support by the tenth day.

The treatment of infected knee-joints was outlined by Willems in the following manner: Opening of the joint through sutured wounds or by lateral incision, no drains of any kind being introduced. Active mobilization was continued, as with the non-septic knees, the patient being awakened at two-hour intervals, night and day, and encouraged to move the joint. As soon as practicable the man was compelled to get up out of bed, and to use the leg in as normal a manner as possible.

The author was very much impressed by the careful painstaking work of Dr. Delroz at La Panne with the joint cases there. The entire morning was spent on rounds, and each patient with a joint injury was encouraged to move his joint under Dr. Delrez' personal supervision. The operative technic carried out on these cases was finished, a clean dissection being made with the

smallest amount of traumatism possible. The work was never hurried, and when the operation upon the joint was finished, one had the conviction that a careful debridement of all soiled tissues had been accomplished.—*Leo C. Donnelly, Detroit.*

POCKETING OPERATIONS AND OTHER SKIN AND FAT TRANSFERS. By John E. Cannaday, M. D., Charleston, W. Va. Maj., M. C., Assistant Chief of Surgical Service, Base Hospital, Camp Sherman; and Leslie S. Brookhart, M. D., Cleveland, Ohio. Capt., M. C., Assistant Chief, Surgical Service, Base Hospital, Camp Sherman. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

The confinement of the operated part in a comparatively fixed position is tedious but not painful. Some of the indications for the transfer of skin and subcutaneous fat are: For the purpose of filling deep depressions caused by the loss of portions of the bony and soft structures of the body. The restoration of the soft parts preliminary to certain operative procedures on bone and tendon. For the purpose replacing large deforming scars of low vitality. To cover large surfaces left by the excision of granulating areas, or by the debridement of bone sinuses. To round out and put in proper condition for weight-bearing, painful and unhealed stumps. To cover recently denuded bone, such as the fingers after severe lacerating and crushing injuries. The technic is simple but must be exact. Flaps for the face, neck and nose are usually taken from the upper arm. For the eye-lids the skin from between the fingers is well suited. For the hand, fingers, forearm and wrist, transfers and made preferably in most cases from the abdominal wall, but also from the chest, gluteal region, outside, front, or inner side of thigh and from the opposite arm. For the feet and legs, transplants are taken from the calf or thigh of the opposite side. The posterior surface of the thigh is a suitable place from which to take a flap for the leg of the opposite side.

The flaps are cut either single- or double-ended, as the exigencies of the case may demand. They are cut about one-third larger than the actual measurements would seem to call for, so as to allow for shrinkage and to avoid tension. The flaps are cut with a generous layer of underlying fat, which carries a good blood supply as well as giving full measure of protection to tendons, nerves or other important structures lying underneath. If a sufficient thickness of fat is used to make the implant rise above the level of the surrounding tissues, the excess of fat will ultimately be absorbed, as nature's constant effort is to restore the natural contour of the body. During the process of healing in place, all skin transplants thicken slightly, but the excess of tissue disappears with use and time.

The suture of the skin edges of the transplant to those of its bed must be done with care and accuracy. The sutures should be inserted very near the skin edges and should be tied with the minimum amount of tension.

In a case of double-ended flaps with the arm projecting through the opening under the same, the skin surfaces of the arm will tend to come in to more or less intimate contact with the chest wall and will interfere with the toilet of the wound of the abdominal wall, making it difficult to keep the suture line dry and clean. These difficulties can be overcome to a con-

siderable degree by the following expedients: The arm may be slightly separated from contact with the body by insertion of rolls of gauze at various points, allowing a circulation of air about the wound and avoiding sweating and maceration of tissues. A bridge made of wire is used to accomplish the same result as the rolls of gauze. No gauze or other conventional dressing materials are applied to the operative wound incident to these plastic procedures. Gauze would only serve by the foreign body reaction to cause irritation and exudation of serum from the raw surface at the base of the flap. The skin surfaces are carefully cleansed with alcohol, ether or Carrel-Dakin solution, several times a day. Wounds are frequently exposed to direct sunlight or to electric light in cold or cloudy weather.

The length of time required for these flaps to develop a new blood supply sufficient to maintain viability after the ends of transplants are detached from the body varies considerably for many reasons. Some surgeons have assumed that ten days is a sufficient length of time, others say fifteen days, but personally we have found it better in most cases to wait for about three weeks in order to insure complete success. If the time has been too short there is apt to be some loss of tissue by necrosis at the severed edges. When a double-ended flap has been used, it is often advantageous to detach one end a few days previous to the other in order that the ensuing circulatory disturbances may not be too abruptly brought about.

After both ends of the transplant have been detached, they are cut to correct shape, the raw edges slightly undermined and sutured in place. In order to secure primary union it is highly important to exercise all granulation tissue about the flap edges previous to suturing. The small raw surface at the base of the flap on the body is treated in a similar fashion. The dry treatment with exposure to electric light or sunlight is continued until healing has taken place.

Conclusions

That skin and fat transplants are valuable for the elimination of cicatricial tissues with their coincident deformities.

That by their use superficial sinuses in bony and soft tissues can be eliminated and depressions can be filled.

That accuracy of technic is essential to success in this line of work.

That the suture line must be kept dry. That the absence of dressings and some form of mechanical support that will prevent the skin surfaces of the arm and body from coming in too close contact are valuable aids.

That months of time are saved the patient.—*Leo C. Donnelly, Detroit.*

Intramedullary Beef-Bone Splints in Fractures of Long Bones. By Edwin W. Ryerson, M. D., Maj., M. C., U. S. Army, Chicago. *The Journal of the American Medical Association.* Vol. 73, No. 18, November 1, 1919.

In fresh fractures and in reasonably young persons, heterogenous bone pegs may be used with safety and with the assurance that bone growth will not be inhibited. Beef-bone and ivory nails, screws and intramedullary grafts have been used by a small number of operators.

Beef-bone splints of various sizes are cut from the long bones of the slaughtered cattle. It is possible to procure from a butchers shop pieces of the tibia or femur 5 or 6 inches long, and these are split with a saw into suitable sizes. They are then turned into a lathe or filed with a wood-workers rasp or run through a dowel cutter so as to be round or nearly round. Those for use in the femur should be about 5 inches long by three-fourths inch wide, for adults, and several smaller sizes should be ready in case the medullary canal should be unusually small, or for use in children. Splints for the humerus should be three eighths inch wide, and those for the radius and ulna, one-fourth to fixe-sixteenths, and three inches long. The ends of the splints are rounded off, and a hole is bored through near one end like the eye of a needle. These splints are then sterilized by fractional sterilization, and kept in containers. When it is desired to use them, they are boiled with the instruments.

The technic of their use is as follows:

The fracture is exposed with as little removal of periosteum as possible. The beef-bone splint is pushed into the longer fragment until it is completely within the bone, a long piece of heavy chromic catgut having been previously threaded into the eye of the splint. This double thread hangs out from the end of the bone. An eighth-inch drill is now used to bore a hole in the other fragment, distant from the fracture about half the length of the splint. The hole slants a little toward the fracture end. A piece of wire, bent at the middle to form a sort of probe, is now passed into the hole and out through the fractured end of the bone. The two ends of the catgut cord are then threaded into the wire probe, and the wire is pulled back through the hole, bringing the catgut with it. The over-riding ends of the fracture are now reduced, either by a Murphy bone skid or by leverage or traction, the catgut cords being tightened at the same time so they will not become caught or pinched. When the bones are in position, the catgut cords are pulled on, and the splint will glide half way from one fragment into the other, so that it will be at exactly the proper point.

The catgut can be threaded into a needle, and sewed into the periosteum or muscle at its point of exit, which will secure the splint so that it will not slide out of position up or down the medullary canal.

Such a splint cannot fit the canal very tightly and it is not necessary that it should, provided that it is prevented from sliding out of place, and this is accomplished by the catgut.

THE PATHOLOGY AND TREATMENT OF STIFF KNEE IN RELATION TO COMPOUND FRACTURE OF THE FEMUR. By Capt. C. Beresford Alexander, R. A. M. C. (T.) *The British Medical Journal*, No. 3063, September 13, 1919.

Fibrous or bony ankylosis of the knee frequently follows compound fracture of the femur when the fracture is into the joint or when there has been prolonged suppuration near the joint.

There is another class of "stiff knee" which follows compound fracture of the shaft of the femur in which the limitation of flexion is not due to

articular so much as to periarticular and muscular changes. This is the type which yields very satisfactory results with careful treatment. Stiff knee after compound fracture of the femur may be due to articular, periarticular, or muscular causes. It is chiefly the changes in the quadriceps which cause stiffness.

In a typical example a markedly wasted and scaphoid quadriceps exists. On passive flexion of the knee, considerable pain is generally caused by periarticular adhesions, but if these are absent, a very much shortened quadriceps prevents flexion for more than a few degrees. This means that the normal function of extensibility and contractibility are absent; that in parts dense scar has replaced the muscle tissue; and that there are scars of healed sinuses reaching down to bone. This state of affairs has resulted from the original injury, the persistence of sepsis, and prolonged disuse.

Histologically the picture varies with the position from which the sections are taken. Those near the septic focus show absolute replacement of muscular tissue by scar, while other sections show decreasing amounts of scar. Soagulated fibrin binds down the muscle fibres.

Throughout the muscle there is considerable shortening of individual muscle fibres, which, in addition to showing marked contraction in size, are in a state of partial degeneration, and as a result of prolonged disuse have "forgotten" how to function. This condition is that of typical disuse—atrophy.

There is a certain degree of regeneration going on as a result of proliferation of sarcolemma nuclei, and muscle cell budding and splitting. The survival of the young muscle cells thus formed depends upon the degree of encouragement they receive to function; otherwise they run the risk of destruction before they reach maturity, either by disuse-atrophy or by condensation of the recently formed scar tissue. Their failure to survive only increases the amount of fibrous tissue formation.

During the treatment of compound fracture of the femur there are all the necessary conditions for the formation of fibrous tissue in muscle—namely, trauma, sepsis, and prolonged disuse. In the neighborhood of the fracture and about each sinus, the muscle is riveted to the bone by dense scar. With a normal joint such a shortened muscle forms a considerable obstacle to flexion of the knee. Similar charges are found about the tendon sheaths and in tendons and ligaments around the knee-joint due to the same causes.

Treatment should be first prophylactic, by chemical sterilization, removal of all sequestra, and early secondary closure of wound when possible. Secondly, any scarring which binds the muscle to the bone and all intramuscular and periarticular adhesions must be broken down. Thirdly, the normal functions of contractibility and extensibility must be restored and growth of young muscle cells encouraged.

As soon as the condition of the wounds permit the quadriceps should be treated by graduated contraction by means of the Bristow faradic coil. This loosens intramuscular and periarticular adhesions and restores tone to the muscle, which begins to increase in size.—*Leo C. Donnelly, Detroit.*

FRACTURE OF THE FEMUR. THE APPLICATION OF WAR LESSONS TO CIVIL PRACTICE. By Carlton R. Metcalf, M. D., Concord, N. H. Lieut.-Col. M. C., U. S. A., in charge of Base Hospital 88, Savenay, France. *Ann. of Surg.*, Vol. LXX, Nov., 1919, No. 5.

Fractures of the femur may be arbitrarily divided into four groups: (1) Intracapsular; (2) Upper third; (3) middle third; (4) lower third. In these several groups we find specific deformities which must be counteracted.

1. Intracapsular.—In war clinics one rarely sees impacted fracture of the hip. We have dealt with loose fractures in healthy young adults.

Deformity.—Upward dislocation of the femur. In neglected lesions there has been persistent adduction of the thigh. To counteract: Thomas splint. Traction, with thigh in abduction to 35 degrees and in flexion to 30 degrees. In this position the foot naturally rotates outward slightly and should be so held. After overriding has been corrected, immobilize in a plaster spica. This is analogous to Whitman's treatment for impacted fracture of the hip.

2. Upper third. (a) Fracture just Above the Small Trochanter.

Deformity.—Upper fragment abducted. (Glutei pulling on great trochanter.) (2) Upper fragment not flexed. (Insertion of iliopsoas is below site of fracture.) (3) Lower fragment drawn upward, inward and slightly forward. (Composite effect of extensors, adductors and flexors on thigh.)

To counteract: Straight traction in abduction.

(b) Fracture Just Below the Small Trochanter.—Common type of fracture.

Deformity.—Upper fragment abducted. (Glutei pulling on great trochanter.) (2) Upper fragment flexed. (Illio-psoas.) (3) Upper fragment rotated outward. (External rotator group—obturators, pyriformis, germilli and quadratus —more than counteract anterior portions of gluteus medius and minimus, tensor fasciae femoris and ilio-femoral ligament.) (4) Lower fragment drawn upward and inward. (Composite effect of extensors, adductors and flexors of thigh.)

To counteract: Thomas splint. Traction, with thigh in flexion to 30 degrees and in abduction (about 35 degrees) until the lower fragment has been brought into alignment with the upper. Flex knee 25 degrees. Support the lower fragment posteriorly to prevent subluxation. Utilize "screw pads." They are attached to longitudinal rods of the Thomas splint. If outward rotation is not overcome by the vertical pressure of the ring of the Thomas splint, it can be compensated by rotating, to a like degree, the lower fragment.

(c) Oblique Fracture, Downward and Inward, Below the Small Trochanter. Deformity.—Upper fragment flexed but adducted (in distinction to the abduction of the two preceding types) by the pull of the adductor muscles inserted near the small trochanter. To counteract: Thomas splint. Traction, with thigh flexed and adducted to bring the lower fragment into alignment with the upper fragment.

3. Middle Third. Deformity.—(1) Lower fragment drawn upward. (2) Lower fragment tilted slightly backwards. (Gastrocnemius.) To counteract: Thomas splint. Traction. Correct subluxation by posterior support. Utilize "screw pads" for insistent pressure on either side of the thigh.

4. Lower Third. Deformity.—(1) Lower fragment titled backward. (Gastrocnemius.) (2) Lower fragment slightly adducted and slightly rotated outward. (Adductor magnus.)

To counteract: Traction, with the knee flexed from 35 to 90 degrees. It is necessary to have firm support behind the lower fragment, especially if traction is made by some means other than calipers.

The deformities which one must guard against particularly are four in number:

1. Excessive shortening, because of inadequate traction or poor position or both. A good result entails shortening of less than one inch.

2. Subluxation of the shaft, because of inadequate posterior support.

3. Rotation of the lower fragment on the upper, with the result that a patient ultimately toes out or toes in.

4. Abduction of the upper fragment.

The Thomas splint serves as a foundation stone in several methods of treating fractures of the femur. Whichever method one employs, a few fundamental facts must be observed:

1. The size of the ring of the splint is not a vital factor, so long as it be large enough. A snugly fitting ring is preferable but not essential.

2. The posterior portion of the ring should impinge against the tuber ischii.

3. This intimate, unchanging contact can be procured only when there is a vertical pull on the ring.

4. The distal end of the splint must be elevated.

5. The Thomas splint should be bent in slight flexion at the knee—ordinarily to about 25 degrees from a straight angle. This amount of flexion is to be increased in fractures of the lower third of the femur.

6. A foot-piece may be erected to hold the foot at a right angle.

7. Posterior support is had by double strips of flannel bandage running behind the limb, from one side-rod to the other.

8. Traction is procured by weight and pulley. The initial weight should be the maximum.

9. If pull and proper position do not suffice to secure alignment, employ "screw pads."

10. Leabe the knee free and uncovered. Massage of the joint minimizes the probability of final knee-joint disability.

11. Examine the splint daily. Adjust the flannel slings, check traction and position. Measure the length twice a week, but do not disturb the fracture needlessly. Check alignment and callus formation with x-ray pictures; a bedside machine is of great help.

12. Watch the perineum. Soap the ring before applying the splint, and soap it daily thereafter. Pearson passes between the ring and the skin a prepared strip of calico, boiled in soft soap. Rub the patient's back with alcohol.

13. Teach a patient some occupational work—knitting, basket-weaving, painting or the like—to busy him during his protracted confinement.—*Leo C. Donnelly, Detroit.*

Flat Foot and Its Prevention. By Edward H. Bradford, M. D. *Journal of Industrial Hygiene*, November, 1919.

There are four important facts, which are often overlooked, to be remembered in considering the working capacity of the feet:

1. The spreading power of the toes and the front of the foot.
2. The strength of the toe clutch upon the weight-bearing surface.
3. The greater height of the inner side of the foot, as compared to the outer side, from the ball of the great toe to the ankle while the foot is in the habitual non-weight-bearing position.
4. The degree of the mid-ankle motion to the inner side. Shoes made for and worn during working hours, without regard to these facts hamper the functions of the foot and impair its normal service.

A large majority of the cases that are unable to engage in any ordinary occupation without foot distress are due to improper foot-wear. This statement does not include the small group of congenitally or paralytically deformed feet. There is no doubt that the shoes commonly worn are the chief cause of foot weakness. The foot is shaped to the shoe more than the shoe to the foot.

The result of the physical examination of the first million draft recruits in this country showed the overwhelming predominance of flat foot as a physical defect. The condition was found in the ratio of 177.45 per 1,000.

Examination of American shoe lasts shows a common disregard of the evident fact that the inner side of the front of the foot is much higher than the outer side when the foot is placed in the strong weight-bearing position. Shoes that are made from lasts which are flat in front, exert pressure on the inner side of the foot, forcing it down to a lower level. To reach this lower level the front of the foot is turned out twisting at the astragalo-scaphoid and calcaneo-cuboid articulations, and the inner arch is pulled in and down. The American last is often not only too flattened in front, i. e., back of the ball of the foot, but also is even concave. In shoes made from such lasts, even if the sole of the shoe is wide, free action of the toes and the toe grip, important in heavy weight-bearing or in fast walking, are seriously hampered, and in anything except an over-loose shoe are made practically impossible.

These defects in the shapes of lasts although important, have received much less attention than they deserve and for this reason they are referred to in this article in preference to other defects already noted by medical writers. A disregard of the above-mentioned facts impaired the usefulness of the army shoe in the last war. Owing to the fact that the army shoe was too greatly flattened at the front to be serviceable, it was necessary to supply unduly long and loose shoes. When this was not done, foot strain was apt to follow.

Reliance is often placed upon arch supporters to help relieve the strain of the superimposed body weight. The stiffened in-soles sold by the shoe dealers for this purpose are useless. What is needed is not a support to hold up the arch of the foot, and thus prevent its flattening, but something which holds the foot from falling, under the body weight, too far to the inside of the mid-line of the leg and foot. Plates constructed to do this effectively are heavy. Moreover, they do not serve their purpose except in the standing

position with the weight falling directly upon them and are not of use in other phases of gait. If continuously used they cause by their pressure, as do splints applied to the limb, weakening of the muscles, and are therefore eventually injurious.

There is no question that the deformity of static flat foot is due to faulty foot-wear and the need of reform in the shaping of shoes is clear. It is necessary that the general public be made aware of the fact that ill-designed foot-wear cripples the feet, and that the manufacturers be convinced of the necessity of improvment in the styles of shoes and informed as to the ways in which this improvement can be accomplished.—*Mark Cohn, M. D., New York.*

Personal Mention

A letter has been received from Colonel Elliott G. Brackett dated Paris, December 1. He refers briefly to his recent study of conditions in the Balkans and other parts of Europe. Dr. Brackett will return to the United States during January.

Dr. John P. Sprague has returned from service and is at 1308 Michigan Boulevard Building, Chicago. His practice is limited to orthopedic surgery and corrective gymnastics.

Dr. Lionel D. Prince has resumed practice with offices in the Flood Building, San Francisco. Practice limited to orthopedic surgery.

Dr. Wilton H. Robinson announces his return to Pittsburgh with offices at 6075 Jenkins Arcade Building. Practice limited to orthopedic surgery.

The Jackson County Medical Society members have decided to give a banquet in honor of the fiftieth anniversary of the entrance into practice of Dr. Jefferson D. Griffith, Kansas City. The banquet will be held about March 4, 1920.

Dr. J. C. Brugman announces to the profession the opening of offices in connection with Dr. H. A. Shaw and associates, Suite 3050 Arcade Building, Seattle, Washington. Practice limited to orthopedic and bone surgery.

By the will of Henry C. Frick, the residuary estate is to be divided into 100 shares valued at about half a million dollars each. The Children's Hospital of Pittsburgh will receive one share.

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